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HIGH-SPEED FREIGHT TRANSPORTATION.

BY S. H. FINCH.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE present time may not be most opportune for proposing innovations and experimental enterprises to the trunk lines of this country, but it may be a time to suggest the necessity for introducing a system of freight movement, the character of which will be indicated and a very brief discussion of general features offered for the consideration of railway managers, although the writer presented the subject to two roads running between New York and Chicago, more than two years ago.

Concerning the introduction of the above service between New York and Chicago, or cities west of Chicago, it may be stated, that the freight transported or transhipped between the larger cities of the country by rail, is handled by one of the three following methods:

1. By ordinary freight-train service.
2. By the so-called fast-freight lines.
3. By the express companies.

The first carries the coarser and more bulky articles, in the delivery of which time is of little or no consideration, the average time being from seven to ten days in moving one thousand miles. In the second, some effort or "exhibition of effort," is made to secure a more rapid movement, and freight is in this way moved one thousand miles in from three to four days. By the third system, which has grown to an enormous business—enormous in more respects than bulk of goods shipped—greater expedition is secured, and express freight is forwarded a thousand miles in about one and one-half days, or but slightly less than thirty miles per hour, including frequent stops at intermediate cities and towns.

The proposed service contemplates no higher rate of speed than this, but much higher than by the fast-freight lines, at least much greater expedition, and while making about the same time as express freight during transit, would differ from the methods involved in the transaction of express companies' business, inasmuch as it is not proposed to collect or deliver any freight whatever—that is to say, no cartage would be performed—but the service would be conducted and considered as some advance on the existing so-called fast-freight lines.

From the foregoing it is obvious that heavy and bulky articles could be forwarded at much greater speed than by the usual freight dispatch, at some greater cost it may be, but the advantages of rapid movement and absence of delay or detention while on the road would make the service of so much more value to inter-State commerce as to compensate fully for whatever additional charge might be necessary to cover the increased cost.

In other words there can be no question but that a middle ground exists between the methods, cost and time of forwarding merchandise by the fast-freight lines, and the facilities offered by the express companies; which is comprehended in the methods here proposed, and which consists in running special freight-trains daily with a limited number of cars at about passenger-train speed, while merchants and shippers provide cartage.

During the past two years many merchants and freight-forwarding agents have been asked for opinions and views regarding the proposed transportation, and they have been unanimous in favor of its introduction. Dealers in fresh fruits have stated in writing that their business would be largely increased, in fact enabling them to reach territory which under existing circumstances affords them no trade whatever.

It goes without saying that the rates charged by the various transportation companies are constantly changing and varying through wide limits, but for present purposes it will be sufficient to mention for comparison what is charged for freight between New York and Chicago.

First-class express freight, $2.50 per cwt.; first-class fast-freight, 60 cts, per cwt.; proposed high-speed system freight, $1.50 per cwt.

It is known that considerable freight can be secured at the rate mentioned, if the time may be depended upon. The actual cost to any well appointed railway would not exceed eighty cents per train mile, for hauling from 50 to 80 tons of freight at 30 miles per hour, while at only $1.00 per cwt., 50 tons would pay $1.00 per train mile.

It has been urged that it was a novelty and that it was impracticable and inexpedient, etc. Now to this it need only be said that there is nothing novel or difficult in practice involved in the introduction of a high-speed freight service between the principal cities. There certainly obtains no difficulty in the actual running of such trains, and no considerable financial efforts or obligations are required. The most serious objection, however, has been that it would interfere and be in conflict with existing contracts between the railways and express companies.

Now while it may so appear to the manager of the express company running over any given road, and in one instance it did so seem, it is maintained that the objection was not well taken, as the methods and business would differ very materially, as would also the class of freight which would be handled. The express business is a "package" business, and implies the collection and delivery of all freight and the transmission of money and valuables, and this business could not be secured or transacted by the system of freight movement suggested.

The proposed service differs in only one feature from ordinary freight transportation, and that consists in a higher rate of speed during transit, or what might be quite as true, greater expedition, which means no side-tracking

or transferring. What is required are not more engines and cars of greater power and capacity, more tracks and yards for making up trains, but more movement expedition. If the premises are correct, it will then be advantageous to undertake a new service that will at once increase daily receipts.

It will be expedient to provide for the business requirements of shippers who have goods that can only be profitably handled in the manner proposed, and which are not at present offered to existing transportation agencies, because too much time is required if shipped by the so-called fast-freight lines, and because it cannot pay express charges or be handled by the regular express companies.

The total through shipments east from Chicago for successive months, since 1878 have been in tons:

	1879	1880	1881	1882	1883	1884
January.....	192,512	163,378	263,872	321,148	257,093	208,060
February.....	193,541	161,541	204,331	225,313	223,212	170,077
March.....	258,458	318,883	212,021	179,145	308,354	258,479
April.....	298,043	136,543	275,417	138,472	147,129	339,312
May.....	230,355	125,157	171,432	115,772	141,011	266,757
June.....	260,234	233,977	242,463	115,305	123,339	219,181
July.....	145,738	130,187	259,253	95,039	113,575	128,061
August.....	162,263	169,314	260,608	138,241	165,168	140,635
September.....	134,141	151,464	265,414	153,234	191,977	130,162
October.....	193,976	179,463	258,374	152,871	123,344	180,899
November.....	168,274	219,840	216,506	214,295	232,713	199,354
December.....	179,154	244,790	259,326	225,406	228,520	187,474
Total.....	2,406,689	2,334,537	2,889,017	2,074,241	2,255,435	2,388,451

Of this large tonnage, the percentage that might possibly be diverted from the regular freight lines would be insignificant so far as mere weight is concerned, but the many instances of vexatious delay and losses incident would make a much more substantial showing if the data were available; but this is by no means the most significant feature, as in many cases an entirely new business would be created. Especially is this true of the fresh fruit and oyster trades, in which but little or nothing is now being done, the dealers in these commodities feeling assured that they can do a business that will be measured by car-loads, profitably at and beyond Chicago, by the introduction of this service, and pay for transportation the maximum rates proposed.

This belief is occasionally substantiated by actual practice during the Summer months by what are called "berry" trains, which are run by several roads leading from fruit-growing regions to the large cities, being run as special trains for the fruit growers, and at much higher speed than ordinary freight-trains, and having practically the same rights as passenger-trains. They have been run at a profit to the roads, and afford the only means by which the fruit growers could successfully dispose of their produce.

Some special arrangements are being made for the garden farmers of Long Island to bring their products to market, and it is quite within limits to suppose that a daily train might be made profitable to the railway and quite satisfactory to consumers, having as its principal object the bringing of vegetables and fruits from the gardens in the Southern States to Northern cities; incidentally mail or passenger cars could be attached to the same train.

It is not however proposed or necessary to discuss the details connected with the management and operating of such a service; they are too simple and obvious. It is only contemplated to maintain the general proposition—abundant evidence having been secured to warrant the conclusion—that a more rapid and expeditious movement of freight is desirable, and that the tendency of all commercial transactions which are affected by transportation, is in the direction indicated.

In addition to the increase of speed implying great saving of time, there is a no less important feature connected with the proposed high-speed service which commends it to the merchant and freight-forwarding agents, which is the element of certainty as to time at which any given lot of merchandise may be delivered; and which is determined by previously prepared time schedules, making the transit and arrival at destination with an equal degree of certainty to that maintained in the transmission of the United States mails; in which case goods may be purchased or ordered by telegraph for "time" delivery with confidence, and many sales thus secured at distant cities that are now lost in consequence of the uncertainty involved in time of transport and arrival if the usual freight service is employed.

PASSENGER-TRAIN CONDUCTORS.

BY A SUPERINTENDENT.

[Written for the AMERICAN RAILROAD JOURNAL.]

UPON reading a recent contribution to the JOURNAL on the subject of "Primitive Railway Service," I was forcibly reminded of the great improvements that have been made during the past twenty years in the minor branches of the service. I mean in the character and general bearing of train-hands—conductors, baggagemen and brakemen. In the early days of railways the qualifications for these positions were not of a very high character. A conductor must be honest and to a certain degree intelligent, a brakeman active and alert, and a baggageman lusty. I doubt if other qualifications were deemed of much account. But time has changed all that, and to-day the average conductor of a passenger-train upon one of our main lines, possesses not only the qualifications of honesty and a limited degree of intelligence, but is a man of good appearance, courteous manners and considerable education. Of course there are exceptions to this rule, but the well-managed road can be distinguished by this class of conductors, and its brakemen and baggagemen are not far behind.

The perfection of train service has been a slow growth, but it is mainly attributable to the development of railway discipline and the semi-military rules that have prevailed. Without doubt the uniforming of railway train-hands has done much toward encouraging an *esprit de corps* among them and improving their general appearance; but there has also been a manifest improvement in the class of men who have applied for and have been appointed to such positions. Every period of financial depression has thrown a number of intelligent and superior men out of employment, and through one influence or another many have secured positions as train-hands upon railways, intending to abandon the pursuit and return to their former occupations when a chance presented itself; but I have observed that the cases are rare when they carry out this intention. Whether there is a peculiar charm about a life upon the rail, or whether the new hand finds

that the position of conductor is one more congenial to the tastes of a man of good attainments or not, I cannot say; but certain it is that the class of men applying for such positions is far superior to what it once was, and every year improves it.

Nor upon reflection does it seem singular that such positions, especially that of conductor, should be sought by intelligent and well-informed men. The responsibilities resting upon, and the capability required in the conductor of a passenger-train are certainly equal to those of a captain of a river or harbor steamboat, and the personal contact with passengers being greater in the former case than in the latter, courteous manners become of greater importance. Good judgment, decision and force are among the essential qualities of a good conductor, and united with the other qualities above enumerated, it is evident that they can only be found among a superior class of men. There is nothing servile in the position of conductor, and he possesses equal authority and importance with the steamboat captain. To my mind there is no question but that a conductor has a far pleasanter and more dignified calling than the ordinary clerk who is tied down to a desk with microscopic chances of bettering his position.

I have said that the well-managed road is particular as to the character of its train-service, but this particularity manifests itself in various ways. Many roads man their trains with men who have risen from lower positions and encourage promotion among train-hands, and this is all very well as far as it goes, but sometimes it works mischief. I can call to mind one road where this "civil service reform" system is in force, and where a more universally unpleasant corps of conductors is not to be found. Strict attention to business, intelligence and capability have been the stepping-stones on this road, and the conductors are certainly reliable men and alert to their actual duties; but it is in those particular and minor branches of conductorship lying without the rigid line of duty that they are singularly deficient. Courtesy to passengers is entirely overlooked, and more than one patron of the road has forsaken it on account of the bearish treatment he has received. A complaint once made to the superintendent of the road regarding the rudeness of a certain conductor, elicited a reply that "the conductor has been with us for twenty-five years, and has risen from the ranks. He may be a little gruff, but he is a most reliable man, and we could not think of dismissing him for such a trifling cause." In cases where promotion is made strictly from the ranks, it is highly likely that reliability will be purchased at the price of courteous address and obliging disposition.

Every road has its rules and regulations which conductors are supposed to observe with rigor, but I hold him a very poor conductor who interprets a *rigorous* observance as an *implicit* observance. Nor do I think that railway management which demands an *implicit* observance a wise one. A conductor should be an intelligent man and being so, to a limited extent, he should be given discretionary powers. It is very well to issue a general order that fare must be collected from all passengers who have not tickets, and in default of payment they must be ejected, but what would be thought of a conductor who ejected a woman who having lost her ticket was also without the means of paying the necessary fare? Ejecting passengers from trains is a delicate matter, and should call for judgment; but an intelligent man can readily detect an attempt to "beat" the road and also a genuine case of distress, and in such cases he should be given discretionary powers. One of the best conductors on my road, if not the best, has been recently promoted to a department of management where he is giving great satisfaction, and this promotion was primarily due to a little incident that came uuder my notice when he had been "conducting" for a few days only. I sat in an ordinary passenger-car when he came through to collect tickets, and I was unknown to him. Immediately in front of me was a poor but respectable woman who was searching for her pocket-book in a manner unmistakably and genuinely agitated. Suddenly she gave a start and exclaimed, "My purse has been stolen," and her agitation took the form almost of terror. I leaned over the seat and spoke to her, expressing the hope that her loss had not been a great one. "No," she answered, "but my ticket was in it and I have no money to pay my fare." My first impulse was to proffer assistance, but the thought occurred to me that I would observe the treatment of the case by the conductor before taking a hand in it myself. The conductor approached her for her ticket, and in manifest distress she explained her predicament to him. He listened politely, and at the conclusion of the brief narrative, looked at her closely for a moment, and then took out his book of rebate slips which State laws generally require to be used in every case where fare is collected on the cars. He punched one and handed it to her. "The rules of the road will not allow me to pass you free, madam," he remarked, "but I will advance the fare and you may return it to me when you reach home. You will find my address on this card." The woman was very grateful, and it is almost needless to say that the conductor had his money returned; but better than all he had shown himself to be a conductor far above the average in courtesy and discretion, and from that moment his advancement was determined upon, if he showed the other necessary qualifications, which he did.

I would not care much for a conductor who set the rules of his road upon a pinnacle and worshipped them as infallible. They are made to be observed, but there are no rules of any kind that can be observed on any and all occasions. In fact to judge of the merits of a conductor I would rather judge of him by the circumstances of his infringement of the rules than by his observance thereof, for courtesy and discretion—two essentials in a conductor—are severely tested in the former case.

I believe in the efficacy of a handsome uniform, both as a means of inculcating discipline and also as an incentive to neatness and general care of personal appearance. I also believe in having good-looking conductors as far as possible, just as I believe in handsome cars; they please the eye. Honesty is the first requirement, and it has been my experience that it is not so scarce a commodity as generally supposed, especially with conductors. Ability and intelligence rank second in importance; but all of the foregoing requisites are of little avail if a conductor be a surly, disobliging fellow, and without sufficient discretion to know when he may "suspend the rules" without fear of censure from his superiors. To obtain this combination of character in a conductor it is evident

that superior men must be employed, and it is worthy of note that upon this principle the leading roads are now acting. Not only are the salaries of such positions as a rule adequate and liberal, but the conductors are treated as employés to whose discretion the company relies to a considerable extent.

LUBRICATING WITH GREASE.

BY E. F. DIETERICHS.

[Written for the AMERICAN RAILROAD JOURNAL.]

EVERY now and then some people who are running machinery conceive the erroneous idea, or are talked into it by interested parties, that it would be a greater saving to lubricate all their machinery with grease in preference to oil. This is as erroneous as if we were to attempt wearing a heavy Winter coat through all the seasons of the year—it would certainly answer the purpose of clothing, but only to our discomfort, and only when we can afford no better.

If the bearings of all our machinery were constructed alike for the proper application of grease as lubricant, and the grease were of such character as to melt freely and spread rapidly over the whole surface of the bearings and cling there tenaceously until it has fulfilled its vocation, there would certainly be the advantage gained of not being obliged to attend to the applying of lubricants as frequently as has to be done when using liquid lubricants. Unless the grease possesses the before-mentioned characteristics and can retain a uniform consistency through changing weather, it will be so stiff and solid in the cups in cold weather and in places exposed to changes of temperature, that considerable heating of the bearings would first have to take place before the grease would become liquefied enough to resume its work. We lubricate to prevent heating, and to depend on heating to create lubrication, is certainly erroneous.

A large amount of grease is made up without the slightest knowledge or regard of the theory of lubricating or the adaptation of the ingredients used, and irregularities of feeding through clogging of the appertures are more likely to occur and cause trouble when lubricating with such grease than when lubricating with oil, if it is clear and limpid.

Grease represents lubricating matter in a solid state, and should therefore also represent its lubricating properties in a concentrated state if expected to do lubricating with efficiency proportionate to that of fluid lubricants. Most of the greases, however, are manufactured mainly for gain, contain very little fatty matter, and that of poor quality, are compounded without skill, and suit the spirit of competition on the basis of greed on the part of the seller and false economy on the part of the buyer.

For lubricating purposes we have pure, fatty matter in a solid state only in animal fat, and there only in the form of tallow, lard not retaining solidity enough at slight rising of the temperature. In vegetable fatty matters we have only palm-butter, which like lard, liquefies, and all other fatty matter applicable to lubricating that could be mentioned as in solid or semi-solid state, are so high-priced or of so limited a supply that their practical use for lubricating purposes is out of the question during the present rage to adulterate everything and the clamor for cheap goods regardless of inefficiency and indirect injury. Paraffine-wax secured from the so-called mineral oils, and stearine obtained from various sources, would both compare favorably with tallow as to solidity but are both of very brittle character.

The oils of animal or vegetable origin, lard-oil, tallow-oil, marrow-oil, fish-oils, olive-oil, palm-oil, castor-oil, cottonseed-oil, rape-oil, linseed-oil, resin-oil, etc., and the mineral oils, which are all more or less used in the manufacture of solid-lubricants (grease), can only be brought into that state by compounding with solid resinous or waxy matter or by partial saponification with alkali or lime and admixture of inert matter.

Tallow, therefore, appears to be the only pure grease that maintains a nearly uniform solidity at all temperatures to which grease is exposed in ordinary handling for lubricating purposes, and it is largely used both as fresh suet and in the refined state, when a solid lubricant is better applicable and preferred to oil.

There is, however, great objection to the use of tallow even in its refined state, as under the slow decomposition which takes place under the influence of frictional heat, and even by long exposure to the atmosphere, the fatty acids are set free, and slowly and almost inperceptibly act destructively on the metal. Tallow requires also a high degree of temperature to become sufficiently liquefied before it is able to spread over the entire surface of the parts under frictional motion, and these parts are therefore compelled to accumulate so much of the frictional heat produced by the motion as is necessary to bring the tallow to and continuously keep it in a liquefied state, and even where it has been melted previously to being applied, the moving parts are obliged to accumulate and run constantly under that amount of frictional heat which is necessary to keep the tallow nearest to the parts sufficiently liquefied. This is precisely the case where tallow used to lubricate locomotive cylinders continuously kept at high temperature in the cups, reaches its destination highly heated and minutely divided, in exactly the proper condition for its decomposition under the influence of the steam and pressure. The quantity of accumulated gummy deposits—a combination of stearine with impurities and metallic abraisions, and the result of the destructive action of the acids on the metal—found in cylinders lubricated with tallow, show that tallow even in its purest state, like all lubricants which contain fatty matter equally liable to decomposition, is by no means either an efficient or an economical lubricant. On heavy bearings, on cranks, etc., this same action takes place only in a manner less appreciable for some time, but finally there also the injurious effect becomes noticeable.

What then can we use for efficient and economical lubricating, where a solid lubricant is more conveniently appliable and would be preferable? There are any amount of solid lubricants manufactured and sold under the general name of "grease," but the question arises, which are the best, most efficient and economical?

When we consider, as heretofore mentioned, that tallow is, so to say, the representative of fatty matter in solid form and find even this wanting in the requirements of a good lubricant in grease-form, and take in consideration its market value, we must at a glance perceive that any

solid lubricant in the market which is sold at less than tallow is worth, must be made up with cheaper and inefficient ingredients, and contain real fatty matter, if any, only in a very limited amount and in proportion to the price at which it is sold.

All grease lubricants depend for efficiency on the amount of real fatty matter they contain, and all the combinations of fatty matter with mineral oils and gummy, resinous or waxy substances, with residuum, tar, paraffine, resin, resin-oil and lime-water, or like admixtures partly saponified with alkalies, or still further adulterated with inert matter like mica, asbestos, lead, plumbago, etc., etc., are valuable only in proportion to the amount and quality of real fatty matter they contain. In many such combinations the fatty matter is of so questionable a character that it is necessary to give the grease a deceptive odor to cover the real nature of its composition. Essential oils are costly and the choice for scenting bulky grease very limited. The cheaper oils, such as sassafras-oil, are sometimes used, chiefly, however, nitro-benzole, a product of the action of nitric acid on benzole, commonly known as myrbane-oil, which has a strong bitter-almond odor, and is likewise used for scenting soaps. Aside from imparting its odor to the grease, nitro-benzole is, however, of no benefit to it; on the contrary rather injurious, especially when impure and improperly made.

All fatty matters whether in liquid or in solid form, except the light mineral oils, have a high fire-test; that is they require a very high degree of heat to become vaporized. As vaporization can only be accomplished by heating, accumulation of frictional heat to that degree must take place when metallic surfaces in close contact with each other are in motion, and when to prevent parts from accumulating heat and injuring each other, lubricating with grease is resorted to. Such amount of heat is sufficient to decompose the fatty matter and the bulk of the component part of the grease, unable to vaporize, becomes an encumbrance, the temperature accumulates, the metal expands, and its abrading and dragging on the motion must follow.

Greases made with resin, resin-oil and lime-water, and admixed with inert matter, can relieve friction only partially as the amount of matter possessing lubricating quality is too limited. Grease made from mineral oils alone, even in their heaviest form with the solid or amorphous wax, can only take care of a limited amount of frictional heat. They liquefy freely but cannot keep a hold on the metal unless assisted by admixtures of resinous, gummy or waxy compounds, which likewise abrade the metal and cause drag on the motion when left by the vaporizing portion of the grease.

When we lubricate with fresh suet, the gummy deposits finally left after vaporization of the oily parts, consist of the charred remains of membraneous tissues which surrounded the globules of fat, and the stearate of the fat in chemical and mechanical combination with abraded metal. With tallow we experience like results, only more prominent, and the accumulations are more bulky. If we lubricate with grease made of mixtures of tallow with addition of resinous, gummy or waxy compounds, we find additional deposits of such admixtures, less the very limited part of their more volatile constituents. If we lubricate with grease compounded with inert matter, we find the cumbersome accumulations still further increased with the exact amount of this inert matter as it is unable to vaporize. Where milk of lime or alkaline-lyes have been used in the manufacture of grease, we find the lime or alkali likewise in the deposits.

It is therefore evident that in all cheap grease lubricants the amount of real fatty matter can only be proportionate to the price and the bulk, and while temporarily serving as a sort of cushion to the real lubricant, becomes finally an encumbrance and a drag on the motion. Lubricating with cheap grease-compounds cannot be efficient and therefore not economical.

We have seen before that lubricating with grease conditions the running of machinery at more elevated temperature on the metal and surrounding atmosphere than when lubricating with oil which is already in a liquid and applicable state, and we should therefore look for the same efficient characteristics in concentrated form in grease-lubricants which we demand in good oil-lubricants. Grease-lubricants of such character, even at the highest prices, will be more economical and efficient than the injudiciously compounded cheap grease-mixtures before mentioned.

The best and most efficient way to lubricate with grease-lubricants is through long slots in the cap of the bearings, which permit the grease to rest direct on the revolving shaft or axle, the slot being provided with covering to prevent dust from settling on the grease. Not every kind of grease can be used in this manner, however, and nearly all, apparently as solid as tallow when put on, soon runs out limpid and powerless, leaving the injurious inert or resinous matter which they contain to clog and injure the bearing; and even suet and tallow, while otherwise efficient will, as mentioned in another place, become decomposed and ere long show their defective character as lubricants.

A grease-lubricant to fulfill all the requirements of efficient lubricating, must possess sufficient compactness for easy application, should melt freely at the slightest rising of frictional heat without running off, and should cling tenaceously to the bearing and be able to vaporize with the frictional heat into space as fast as it is produced by the friction. The grease should contain no fatty matter in a free state which forms fatty acids and becomes rank; no resinous, gummy or gritty matter, and should retain a nearly uniform consistency at different temperatures and not lose its efficiency in warm places. Grease of this character would also work more satisfactory through cups devised and used for applying the numerous kinds of grease, notwithstanding the difficulties attending the lubricating with grease when feeding through limited apertures.

There are lubricating oils which are manufactured in such manner that the fatty acids are properly bound to a basis and incapable of decomposition, forming a perfect neutral oil, free from gum, resin, gelatinous or inert matter of any kind. In their concentrated state they form the most efficient grease-lubricant; equally pure and possessing the same excellent adaptations for lubricating, it melts freely and clings tenaceously to the bearings.

The use of grease on railway car-trucks has long been abandoned for the more unreliable attempts at application of cheap, dirty oils through waste on the capillary principle. Cheap, and therefore poor quality grease, did fail to give satisfaction, but this is no reason why grease, judi-

ciously made, with proper and direct application to the axle, would not be by far the more efficient, reliable and more regularly-working lubricant for truck-axles. There is the factor of saving in motive power, time, wear and care, annoyance and delays, besides ahead of all, safety, on the side of the efficient, moreover more expensive lubricant, against the apparently cheaper ones, the protégé of influence, ignorance and false economy.

THE LOCOMOTIVE OF AMERICAN INVENTORS.

AT an entertainment given in Brooklyn recently by the Kings County Association of Practical Engineers and Machinists, Mr. Angus Sinclair, one of the editors of the *American Machinist*, delivered a lecture on "The Locomotive as Developed by American Inventors." His remarks were, in substance, as follows:

Many people who ought to be better informed believe that the steam-engines that operate our factories, propel our steamboats and pull our railway trains are merely imitations of machines originally imported from Europe, and that all our pioneer mechanics did was to develop the engines and adapt them to American purposes. The facts are very different. If James Watt, the inventor of the condensing engine, and the crowd of Englishmen reputed to be the inventors of the locomotive had never been born, and the work they performed had remained undone, it is doubtful if the mechanical progress of America would have suffered materially. When James Watt in Scotland was struggling to obtain the means of developing the condensing engine, Oliver Evans, a native of Delaware, was engaged working out the invention of the high-pressure engine, where power was obtained direct from the expansive force of steam. Both inventors started from the same point, which was the atmospheric engine of Newcomen. Watt aimed at using steam very little above the pressure of the atmosphere, the vacuum formed in his condenser being the principal source of power. His engine was necessarily a ponderous, slow-moving machine. Evans, by high pressure of steam and high piston speed, aimed to get high power with little weight of engine. Mechanically, Evans was as successful as Watt, but America did not then need the steam-engine badly, for her industries were few and her water-power unparalleled, which accounts for the nation's indifference toward Evans's great invention. Under such discouragement, Evans perfected his engine and established its utility.

Although his work has never received proper recognition from the mechanical world, Evans's engine is the prototype of the high-pressure, high-speed engine that became our national pattern, and of which the locomotive is the most successful example. Readers who receive impressions about the history of inventions from English sources are made to believe that the high-pressure engine was invented by Richard Trevethick. Evans applied for a patent on the high-pressure engine fifteen years before Trevethick began experimenting in that line. The origin of the popular mistake is that English writers on the subject of the steam-engine, while perfectly intimate with the scientific experiments made in Greece and Egypt thousands of years ago, are profoundly ignorant of what is going on in America in their own time. During Evans' time many engineers believed that steam might be successfully applied to land-carriages on common roads, and Evans attempted to apply his engine in this way; but a little experience with the difficulties encountered convinced him that the plan was impracticable. That a steam-engine could run a carriage on common roads under favorable circumstances he proved by making the engine of a steam-scow he made for the city of Philadelphia propel the craft, which was mounted on wheels, through the streets of the city. This was the first case of a carriage being moved by steam on the American continent, and it was done in 1804. Oliver Evans was a prolific inventor and a highly accomplished mechanic. His steam-engine made but little progress into favor during the life of its inventor, but he had perfect faith in its great future. He predicted that his high-pressure engine would be the means of accelerating travel, so that people would leave Washington in the morning, dine in Philadelphia and sup in New York.

The assertion is often made that nothing was done in this country toward building railways till the opening of the Liverpool and Manchester Railway in England proved the success of railway operation to be no longer doubtful. That is not true. There were several short railways in operation in America before the Liverpool and Manchester Railway was opened, and when that well-advertised event took place there were more railways progressing in America than there were in Great Britain. Moreover, an American railroad company was the first in the world to decide that their road should be operated by locomotives. When the directors of the first English railway intended for general traffic were disputing about what power they should use, the majority favoring stationary engines and rope traction, the directors of the Charleston and Hamburg Railroad unanimously decided that they would use locomotives, and gave their manager permission to have the engines built. Which country should first produce a railway that would demonstrate the real value of that system was for a time doubtful. America was poor, but enterprising, and money to build expensive railways was hard to raise. England was rich, but conservative, and the majority of the people were contented with existing institutions and hated change. The friends and advocates of railways in America were not waiting events in Europe to teach them that work was to be done here. The canals that had been constructed at great expense did not prove satisfactory. A few years' experience of them brought many public men to favor railway building. During the decade from 1820 to 1830 this sentiment grew and strengthened rapidly. It produced fruit in the shape of numerous railway enterprises. Individual corporations and legislatures were striving to start the movement, which eventually gave America the finest railway system in the world, and it was only want of available capital that prevented this country from anticipating the railway era by eight or ten years. In 1823 the legislature of Pennsylvania incorporated a company to build a railway from Philadelphia to Columbia, and this became the opening section of the great Pennsylvania Railroad. The Delaware and Hudson Canal Company was also chartered that year, with permission to build a railway as well as a canal. In 1826 a short railway was opened at Quincy, Mass., and during this year the Mohawk and Hudson Railroad Company obtained the right to build

what was destined to be the first railway opened in New York State.

Urging on these railways was the pursuit the progressive men in America were engaged in when George Stephenson was being badgered in the committee rooms of the British house of commons, and popularly regarded as a madman for proposing to move railway trains at a speed of ten miles an hour. The first railway in America that tried operating by locomotives was the Delaware and Hudson Canal, and their first engine, the "Stourbridge Lion," was imported from England. It was a very primitive concern, with a single-flue boiler and upright long-stroke cylinders with the pistons connected by a walking-beam. This locomotive was taken to Honesdale, Pa., and the first trial took place in August, 1829, two months before Stephenson's "Rocket" made her first run in England.

It is often asserted that the designers of locomotives for the pioneer American railways followed British patterns and modified them to suit the condition of their own tracks. This theory does not seem to be supported by facts. The first locomotive built in America for regular railway work was the "Best Friend," which was made at the West Point foundry, New York, for the Charleston and Hamburg Railroad. This engine had an upright boiler and two cylinders set almost horizontally, the piston transmitting the power direct to a cranked driving-shaft. The water-tank and cylinders occupied one end of the carrying frame and the boiler the other. The whole was carried by two pairs of driving wheels coupled by outside connecting-rods. This engine was designed after a model made by the late Peter Cooper, and it had nothing to indicate that the designer had ever seen any of the early English locomotives. In 1830 a small working-model locomotive made by Mathias W. Baldwin attracted much attention, and the maker received an order to build a locomotive for the Philadelphia and Germantown Railroad. The engine was called "Old Ironsides," and in a public trial made a mile in fifty-eight seconds.

Since 1830 the principal improvements effected in locomotives have consisted in working out details, increasing the size of parts, adding conveniences for operating and for promoting economy. In this work of development, the American mechanic has performed an important part. In 1835 the AMERICAN RAILROAD JOURNAL, speaking of railway machinery, says: "There are seven Baldwin engines at work on the Pennsylvania Railroad, on which they have also two English engines from the workshops of the celebrated maker, R. Stephenson. The engineer who has charge of the locomotive department informs me that the power of the American engines is 35 per cent. greater than the English." The first lines of improvement worked on by American locomotive builders were, making the engine adapted to the track, proportioning the working parts so as to obtain security from breakage and durability in service, providing means to keep enginemen protected from the weather, and the restraining of spark-throwing from the wood used as fuel. The adapting of the boiler to use anthracite coal was soon made a success.

Let us review the work done by the American mechanic and inventor toward developing the locomotive. Here is an eight-wheel locomotive, good for mostly any kind of service. The multitubular boiler, so efficient in steam making, is the invention of Nathan Read, an American. It is carried in compact shape by four coupled driving-wheels and a four-wheel truck, a combination patented in 1836 by Henry R. Campbell, of Philadelphia, the truck having been previously invented by John B. Jervis, of Rome, N. Y. The driving-wheels are of cast iron, made hollow, the invention of Thomas Rogers, who was also the first to use weights on the wheels to counterbalance the momentum of the reciprocating parts. Allen paper wheels—a thorough Yankee notion—carry the engine truck, and the tender is carried by cast iron chilled wheels, first invented by Ross Winans. The single-bar frame holding cylinders placed horizontally and bolted together in the center, is a remarkably strong and compact combination, designed by William Mason. The weight of the engine is distributed evenly to the axle boxes by means of equalizing levers invented by Joseph Harrison, of Philadelphia, in 1837. Two fixed eccentrics, invented by James, of New York, give movement to an Allen slide-valve, balanced by a Richardson device. And lastly, the engineer sits in his cab with the full confidence that the whole train is completely under his control through the power furnished by the Westinghouse automatic air-brake, the greatest life-saver of this country.

SOUTHERN RAILWAY LEGISLATION.

THE Southern States have been somewhat behind their more active Western brethren in the formulation and adoption of stringent legislation for the purpose of regulating the railroads. This has been due in part, no doubt, to the natural conservatism of the Southern people and their disposition to let what appeared to be well enough alone; and perhaps the peculiar unprofitableness of nearly all railroad enterprises in that section may have deterred them from restrictive legislation.

It is true railroad commissions have been established in several of these States during the past few years, and two of them with very extended authority; but in the main there has not been any strongly organized general effort in this direction until this Winter.

A railroad commissioner was created in Virginia in 1876, but his duties are simply of an advisory character—the law having been fashioned somewhat after that of the Massachusetts law. The people of Virginia do not seem to have been dissatisfied with this arrangement. The local rates are generally fair and satisfactory, and, so far as railroad development is concerned in that State, Virginia is relatively in advance of any of the Southern States—there being a mile of railway to each 14½ square miles of territory and 588 of population, while the average for the entire South is one mile of road to 30.7 square miles, and to 638 population.

In North Carolina there is no railroad commissioner, but there are general laws against pooling and discrimination in rates, by charging more for a shorter than a longer distance.

In 1883, South Carolina established a board of railroad commissioners, with authority covering the regulation of rates, discrimination, interchange of traffic, and with other very extended powers. Their first move was to make sweeping reductions in the rates for both passengers and

freight, which, with the decreased cotton crop that year, was the cause of much complaint by the railroads. During the fiscal year ending June 30, 1884, about half the railroad mileage in South Carolina failed to earn fixed charges, and only two roads paid any dividends on their stocks, although the bonded indebtedness of the roads in that State is only an average of $16,227 per mile. This law was modified during the session of 1883-84, by rescinding the authority to make rates on freight, but the rates on passengers are still regulated by law. The temper of the people of South Carolina and the press seems still in favor of restrictive legislation.

To Georgia belongs the credit of being the first Southern State to imitate the granger legislation of the West, and in 1881 a board of railroad commissioners was created with almost absolute powers over the railroads in that State. Large reductions were made in the rates on both passengers and freight. The funded debt of the railroads in Georgia is only $12,413 per mile, and the stock $12,574 per mile—a very moderate capitalization; certainly not more than the cost of the roads. Yet out of a total mileage of 2,887 miles, only 1,855 miles pay any dividends on the stock. The result of this legislation in Georgia, seems to have contributed to hinder the flow of outside capital into that State for the purpose of railroad construction, and there are no important railroad enterprises on foot there, either at present or in prospective. In Tennessee the decision of the United States Circuit Court last year, restricting the powers of the railroad commission of the State in their relations with railroads extending out of the State, has secured the roads from an immediate interference. In the remaining Southern States the railroad legislation has been of a comparatively mild character, and they have been left to themselves to develop and reduce their rates by natural competition. During this Winter strong efforts have been made in the legislatures of Florida, Alabama, and Texas, toward the enactment of laws and the establishment of railroad commissions, with powers similar to those existing in Georgia. Our advices from Florida indicate there is an undercurrent of strong feeling against any legislation that will in any way interfere with or hamper the railroad development in Florida, and the various bills introduced are likely to be defeated.

In Alabama the legislation recommended by the board of railroad commissions, which was of an exceedingly rigid character, was very decisively rejected in the House of Delegates. A bill somewhat similar in its terms introduced in the Senate, was so amended as to deprive it practically of all its original restrictive features and then passed, but it will probably be smothered in the House. The general feeling of the people of Alabama as reported, and of the press, seems conservative and opposed to further onerous railroad laws such as those proposed. They are doubtless aware that the railroad mileage of Alabama consists of only one mile of road to each twenty-seven square miles of territory, a great disparity between it and the average of the entire country, which is one mile of road to seven square miles of territory, and there are thousands of square miles of rich mineral and agricultural lands in Alabama undeveloped and comparatively worthless, for want of transportation facilities. The temper of the people of Alabama, as indicated by the press, evidences a desire to invite the investment of outside capital in that State. In this they have displayed a wise and thoughtful course, which is said to have given much assurance to the owners of railroad property there, and confidence in the future prosperity of the State. The wonderful increase in the manufacturing industries of that State during the past few years, which is but a fraction of the possible development of its resources, has drawn the attention of investors to its advantages, and a conservative and protecting course on the part of the lawmakers, will no doubt bring to it a large amount of capital at the first return of confidence.

There have been several bills introduced in the Texas legislature recently looking to the regulation of the railroads, and considerable discussion is going on through the press for and against such legislation, but it is difficult to determine on which side of the question is the weight of popular feeling, and the result can scarcely now be foreshadowed. A bill similar to the Reagan Inter-State bill, modified to fit the State, is attracting some attention, and is probably the most decided legislation proposed. If it is true, as it is claimed, that the rates on cotton from the interior of Texas to Galveston are much higher than to St. Louis, a thousand miles further, then the friends of the modified Reagan bill will have a good argument in its favor; but a law which would remedy this individual difficulty would have to be general in its scope, and while reforming one guilty road, other innocent roads would suffer. There are thirty railroad companies in Texas, aggregating over 6,000 miles, not one of which pays dividends on its stock, and the majority of which scarcely earn their fixed charges. In view of these facts, it would seem that the Texas railroads could not stand much regulation of the Georgia or South Carolina kind. The Southern States have entered upon an era of prosperity which is indeed gratifying to every friend of that section. The railroads have been an important influence in the accomplishment of this result. It is true they have received large benefits from the people, and it is desirable that they should be subjected to such wise laws as will conduce to the efficient fulfillment of their duties as channels of transportation. But the interests of the South cannot be served by laws which seek to deprive investors in railroad property, nor of other property, of a just and reasonable return from their investments, and it is hoped that the Southern States will enact no laws, which, by depriving capital already invested of its rightful remuneration, will intimidate and drive away capital which would otherwise seek investment there.—*Bradstreet's.*

The Advantages of Railway Pools.

CHIEF NIMMO, of the Bureau of Statistics, in a recent report, advanced the following arguments in favor of railway pools:

Pooling organizations appear always to occupy a position of unstable equilibrium. They have the support of a sense of self-interest, and faith in an administrative head, but they lack the third essential element of support, viz., legal recognition. Their instability tends, however, to disarm the suspicion in the public mind that they are essentially combinations inimical to the public interests.

In conclusion, the following general observations may be made in regard to railroad federations and pooling organizations:

1. They have been instrumental in preventing unjust

discriminations through secret rates to favored shippers, and the consequent demoralization of trade.

2. They have prevented many unjust and ruinous discriminations against towns and cities, and against particular States or sections of the country.

3. They have put a stop to violently fluctuating rates.

4. They have had the effect of protecting the weaker lines and of preventing their absorption by the stronger lines, and thus of conserving elements of competition in transportation.

5. By preventing the absorption of the weaker by the stronger lines, they have prevented the threatened danger to the country of its being districted among a few great corporations, by which means the regulating influence of the competition of trade forces would have been eliminated, and transportation would have gotten the mastery of trade.

6. They have tended to prevent those shocks to the financial interests of the country which generally accompany the bankruptcy of great railroad corporations.

7. Since they have been adopted the railroad transportation facilities of the country have been greatly extended. The volume of traffic has also enormously increased, and rates have constantly fallen. These facts seem to prove that railroad federation has not had the effect of obstructing the beneficial operation of the overruling competition of trade forces and of the direct competition between transportation lines. Statistics hereinbefore presented clearly indicate this fact.

8. The most hopeful aspect of federations for the division or pooling of traffic is that thereby the railroads have been brought to a condition in which their accountability to the public interests may be more clearly defined, and in which any departure from undoubted principles of right can be observed and the responsibility therefor located. It is believed to be much easier to regulate great federations of railroads with respect to matters relating to commerce among the States than to regulate a great number of railroads acting independently, for the reason that these federations constitute concrete expressions of relationships and antagonisms both among railroads and among trade centers, and tend to illustrate the relative force of the same.

9. Railroad pools have not proved to be rigid compacts, but they have been constantly subject to change. Occassional and even protected wars of rates render their requirements at times almost entirely inoperative. This must, in the light of public interests, be regarded as a favorable symptom of their practical workings. The conditions surrounding and governing the commercial and transportation interests of the country are constantly subject to change, and it is impracticable that any fixed rules or set of rules should be formulated which in practice would tend to prevent such changes.

It has been suggested that the national government ought to recognize pools and to enforce the observance of their agreements. But their present unfixedness, and the many failures fully to accomplish the results at which they have aimed, seem to render such a step, at this time, premature.

It would be unwise at the present time to assume that no better expedient than pooling can be adopted for the protection of the commercial, industrial, and transportation interests of the country against the destructive and demoralizing results of wars of rates, or to assume that railroad pools as they exist to-day are not susceptible of such improvements as would greatly advance their usefulness.

It has been the object of this brief disssertation upon railroad pooling organizations to describe them historically and in their practical workings rather than to pass judgment upon them. Their relations to the transportation and commercial interests of the country constitute a large and exceedingly important question, and one which might well engage the earnest and careful attention of a national railroad commission.

From America to Russia by Rail.

"THE idea of railroad communication with Alaska will doubtless appear almost preposterous, to many people; but I believe the coming generation will live to ride from Minneapolis to the mouth of the Yukon in a railway coach," said Lieutenant Schwatka, the Alaska traveler and explorer, recently to the reporter of a Western paper. "The Russians are now contemplating the construction of a railroad to the river Amoor, and it is not unlikely that they will continue to the Pacific Ocean to a point opposite Behrings strait. Should this be done the building of a road from some point on the Canadian Pacific, which shall traverse the British possessions and Alaska and connect with the Russian railway will be only a matter of time. The strait at a suitable point of crossing is so narrow that passengers and freight could be easily transported in Summer time from the terminus of one road to that of the other, and in Winter time a regular track could be laid on the solid ice. Just imagine yourself traveling from Chicago to St. Petersburg in a Pullman coach without change of cars. It is a possibility whose realization is more than probable. And I think the project would be a paying one, too. It would not, perhaps, have any serious effect upon ocean traffic, but the route would be largely patronized by European travelers who dread an ocean voyage. There is no reason why a railroad should not be operated successfully in those northern regions, and I do not think there would be any more blockades from snow than in this country. Yet, should this ideal scheme for traveling by rail from one continent to another fail of consummation, we may reasonably expect our railroad to Alaska. The country is able to support as great a population as our average State, and there is no reason why it should not attain the growth of Norway and Sweden. Indeed, it is growing noticeably now, and the immigration in the future will be steady and substantial. The fisheries of Alaska are almost exhaustless. The real fisheries will last forever, the cod-fish will certainly hold out, while the whale and salmon abound in great numbers."

"Are there other resources?"

"Yes; in all probability there exists much mineral wealth. During my trip down the Yukon I found numerous indications of gold, and the river Tanana, at present the largest unexplored stream in the world, gives evidence of the existence of precious mines near its head waters. On Copper river there is known to be much copper, which the Indians have brought to the trading posts in pure sheets. Of course, the mineral interests are all prospec-

tive, but it will not be surprising to see a rush to the country as a result of a discovery of gold in paying quantities. Alaska is still in a very undeveloped condition; it is only last year that a government was given. It is yet crude, though much better than the shotgun rule. It is now possible to take up land under squatters' rights, though the country must first be surveyed before formal grants can be made."

"What is the prospect of the Aleutian Islands?"

"There is a great opportunity for some large monied company to take up these islands and devote them to grazing purposes. The climate is so mild that there will not be any trouble in raising cattle successfully, as grazing is very fair all through the Winter. The islands, I think, will support over 400,000 cattle, enough to supply the whole market of San Francisco and the tributary country."

"Do you ever intend to make another Arctic trip?"

"No; I have had quite enough of that region. I will confine my explorations to Alaska, and am already contemplating another trip this Summer."

Railway Sanitation.

DR. RAUCH, secretary of the Illinois State Board of Health, issues the following circular to the railways of the State:

In connection with the sanitary survey of the State and the house-to-house inspection now being prosecuted under the direction of the State board of health, with reference to the probable advent of Asiatic cholera, your attention is respectfully called to the great good which, at little expense, you may accomplish in two directions—First, in a practical cleaning up and abatement of possible nuisances upon your own premises, and second, in furnishing an object-lesson in sanitary work to the various communities along the line of your road.

The spread of Asiatic cholera is due oftener to the pollution of the water supply than to any other one cause. There is no commoner mode of such pollution than through foul, badly constructed and improperly located privies and water-closets. The disease in this country being always due to importation, and its spread being most commonly by persons traveling from place to place, it follows that railway privies and water-closets are especially exposed to the danger of cholera infection. In view of these facts it is earnestly requested that you cause all such places in conneetion with stations, freight-houses, shops and round-houses to be at once inspected and put in good sanitary condition.

Vaults should be at once emptied—before warm weather makes such work dangerous—and thoroughly disinfected with sulphate of iron (copperas). Where these vaults are within fifty feet of any source of water supply—well, spring, pond, lake or running stream—their further use should be abandoned, and after being emptied they should be disinfected and filled up with dry, clean earth—in itself one of the best disinfectants. The new vault should be not less than fifty feet from the nearest water supply; should be water-tight; ventilated by a four-inch shaft, opening above the roof; the contents should be kept inoffensive by the daily use of dry earth or some other disinfectant; and the building and its surroundings should be kept in the cleanest attainable condition. Where practicable the substitution of the earth-closet system for the subterranean vault-storage is recommended. In either case the frequent removal of the contents, and their safe disposal by use as manure are imperatively sanitary measures.

One of the most important roads in the State has already taken the action above indicated along the entire extent of its line. This board, in its effort toward preventing epidemic disease and consequent interruption and loss of travel and traffic, will be glad to learn of your action in the premises, and to furnish any information or assistance in its power.

Belgian Railway Progress.

A PETITION is about to be addressed to the Belgian Minister of Public Works, praying that orders may be shortly given out for such new rolling-stock and plant as is likely to be required this year upon the Belgian state railways. The price submitted for rails required for local railways in Belgium has been notably reduced after further consideration of the specification. From £5 18*s.* 4*d.* per ton, the price has been brought down to £5 6*s.* per ton. The profile of the rails has been modified so as to admit of their being rolled more easily and readily. Attention is being more directed to the introduction of metallic sleepers upon railways as a means by which Belgian iron masters would be enabled to extricate themselves from some of their present difficulties. A contract has been let for 3,000 axles required for the Upper Italy Railway. The lowest tender was that of the Valère Mobille Company, which offered to supply the axles at £7 15*s.* 6*d.* per ton, delivered free at Genoa; Krupp, of Essen, tendered at £8 14*s.* 9*d.* per ton. The Cockerill, Bochune, Ougrée, &c., companies also tendered. The export of steel rails from Belgium in January amounted to 1,485 tons, as compared with 220 tons in January, 1884; the exports of iron rails were only 56 tons and 95 tons respectively.

Looking After New Cars.

IT it often a matter of pride with car-builders, says the *National Car-Builder*, to have a new car go out on the road and not make its appearance in the shops for eighteen months or two years. We question whether this is good policy. Would it not be much better to have the car come in after six months' service, to have the rods and bolts tightened, cracks in joints stopped, and other precautions taken of a similar kind? When cars are built of timber which has not had a long and thorough seasoning, an overhauling is necessary after a few months on the road. When seasoning-cracks in paint and varnish are closed, the truck taken down, and all looseness due to shrinkage taken out, the car is better fitted to run two years or more without coming into the shop than it was to run a year when first completed. If the history of some of the oldest cars in service could be traced, it would be found that they had been well cared for at first. The life of a car is almost unlimited if the joints can be made weather-tight, the frame kept dry, and the slack of rods, braces and trusses taken up as often as shrinkage

makes it necessary. Cars frequently become rotten at the window-sills and in the posts from weather cracks. These cracks make their appearance in many cars before the varnish needs renewal. Such cracks could be economically stopped without the necessity for re-varnishing. Sometimes the work can be done so quickly that the car will only be detained a few days in the shop. It is very important to have all the iron work of the truck perfectly tight. This prevents the joints from grinding and wearing. While these things are generally understood, they are too frequently neglected, and the result is a great loss to the roads. Cars which should be sound and strong in their frames for twenty years, get out of shape in half that time. The only cause for this is neglect to keep the frame dry and the nuts and trusses tight.

Cost of Operating Early Locomotives.

THE *Engineer* has recently published a good deal of information about early English locomotives, and among other things gives a table of the cost of operating locomotives on the Liverpool and Manchester Railway for the six months ending Dec. 20, 1844. Reduced to cents per mile run this was:

		Cents.
Fuel (coke)		4.04
Oil and tallow		0.44
Waste		0.02
Wages		2.77
Repairs:		
Materials	0.66	
Labor	1.72	
		2.38
General charges, water, cleaning, tender repairs, round-houses, salaries, etc.		3.87
Total		13.52

The coke burned by mile run was 21.5 lbs. The cost of new engines was almost exactly $2,000 each. The weight and load hauled are not given. The statement includes 20 "coaching" engines, 14 "luggage" engines, and 6 "jobbing" engines.

The ratio of labor to material for engine repairs on English railways is now as nearly as may be half of the total instead of nearly 75 per cent., and the total cost a little over 6 cents per train-mile.

Railways of the World.

SOME statistics are brought forward by the Minister of Public Works in Germany, in a report entitled "Archiv fur Eisenbahnen," from which it appears that at the end of 1879 there were in the whole world 350,031 kilometers of railways, which by the end of 1883 had increased to 442,199. Of the 92,168 kilometers constructed in that interval, the United States are responsible for 56,327, while of the more backward railway-making countries 3,727 kilometers were made in Mexico, 2,160 in British North America, 2,050 in Brazil, 2,786 in India, 3,603 in Australia, and 1,166 in Algeria and Tunis. Of the European States, the most active countries in constructing railways during the four years, were France, with 4,500 kilometers, Germany with 2,716, and Austria-Hungary with 2,262; while, on the other hand, the countries with the oldest railway systems and the densest population made comparatively few extension, Great Britain being only at the rate of 1,399 kilometers, Belgium of 257, Holland of 282, and Switzerland of 302. At the close of 1883 the United States was a long way ahead of all other countries in railway mileage, possessing 191,356 kilometers, Germany had 35,800, while France and Great Britain ran a pretty equal race with 27,688 and 29,890 respectively. The smallest railway owner was Greece, which possessed but 22 kilometers, though this proportion is now raised by the opening last year of 100 kilometers between Volo and Larissa.

The Pike's Peak Railway.

THE Pike's Peak Railway, which is expected to be in operation this year, will be the most notable piece of track in the world. It will mount 2,000 feet higher than the Lima and Oroya Railway in Peru. It is now in operation to a point over 12,000 feet above the sea level. The entire thirty miles of its length will be a succession of complicated curves and grades, with no piece of straight track longer than 300 feet. The maximum grade will be 316 feet to the mile, and the average grade 270 feet. The line will abound in curves from 500 to 1,000 feet long, in which the radius changes every chain.

A Valuable Train.

PERHAPS the richest train that has passed over any road in this part of the country was that which went over the Hannibal and St. Joe one day recently. The train was composed of two cars of gold bullion, three cars of silver, eight cars of silk, and four cars of tea. The gold and silver were from Colorado, destined to the Philadelphia Mint. The silk and tea were from California, going to New York.

THE whole exports of iron rails in January from Great Britain were only 1,269 tons, as compared with 832 tons in January, 1884, and 3,245 tons in January, 1883. The whole exports of steel rails sunk to 26,563 tons, as compared with 38,544 tons in January, 1884, and 68,276 tons in January, 1883. The combined exports of iron and steel rails in January were only 27,832 tons, as compared with 39,376 tons in 1884, and 71,521 tons in January, 1883.

THE shunting locomotives in the Prussian service are to be provided with a fire-extinguishing apparatus, by which they can be converted into fire engines at short notice. This arrangement has already been tried in a few cases, and has proven itself of so much service that it is now to be applied universally.

A COMPANY has been formed in Allegheny, Pa., to manufacture iron ties, with a capital of $50,000. They propose to make an angular hollow tie, which will resist concussion as well as wooden ties. Oak timber is disappearing so rapidly that iron ties will soon become an absolute necessity.

IT is claimed by *La Nature* that the highest railway viaduct in the world is that of the Garabit bridge, France. That remarkable structure is 1,800 feet long, and near the middle of the great central arch the distance from the bed of the river to the rail is 413 feet.

IT is computed that there were 52,000 locomotives upon the railways of Europe in 1882. The number of passengers carried during the year was 1,371,000,000, while the aggregate weight of goods carried was 715,000,000 tons.

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THE AMERICAN RAILROAD JOURNAL enters upon its fifty-ninth volume with every indication pointing to a prosperous year. Having definitely adopted as its special field the mission of a railway magazine and review, with which the railway world had not hitherto been furnished despite the numerous publications devoted to its interests, it will continue to be published in its present form, providing a number of interesting contributions each month, together with a careful selection of the most valuable articles appearing in its exchanges, brief notes of interest from a railway, and in fact from a general standpoint, editorials and editorial notes on the railway questions of the day, a live and vigorous department devoted to the growing interests of street-railways, and a department in which the principal new railway and street-railway inventions are described and illustrated. New features will be added as occasions present themselves, and it will be the aim of the publishers to render the JOURNAL a welcome monthly visitor in railway offices, to managers, officials, operatives, and railway men in general. Typographically it ranks among the first, and its present attractive appearance will be maintained.

We again invite and solicit contributions from every source, promising publication in every case where the contribution is of interest and value, and prompt and liberal payment will be made for such contributions. Unfamiliarity with the pen should offer no barrier to the preparation of such contributions, for we are always willing to revise contributions before putting them in type, and the *meat* is what we want—not the dressing. Many old and experienced railway men feel that they could contribute something of value, but are prevented from so doing by their lack of experience in preparing articles for the press. We desire that this shall not stand in their way, for like the ancient sage we believe that a block of marble in the rough is of greater value than a millstone carved into a statue by the hand of a Praxiteles.

It is not to be supposed, however, that contributions form our only desideratum. What we want quite as much are subscribers, and we believe we will get them. Our subscribers have steadily increased since the present style and form of the JOURNAL was adopted in June last, and our new readers are to be found in every branch of railway service, from the shop to the office. The character of the JOURNAL'S contents fits it for general railway reading, and it ministers to one class no more than to another. In the present volume we trust our subscribers will still further increase, and it follows as a natural consequence that the greater the number of readers, the more interesting and valuable can the JOURNAL be made.

Still another branch of the railway interest from which we ask a hearty support—the railway supply men. As an

advertising medium the JOURNAL is unexcelled. Being a magazine and review, containing matter not of mere ephemeral interest, it is carefully preserved, read and referred to a number of times, and generally bound at the close of the year. Thus our advertisers may be certain that their cards will be constantly before the eyes of our readers, and not subjected to a hurried observation before the medium is consigned to the waste-basket. The advertising rates of the JOURNAL are exceptionally low and its advertisements are artistically prepared and advantageously placed. The rates and terms of payment are conspicuously placed upon the first column of its editorial pages, and nothing is hidden from view.

Having bespoken the good-will of the contributing, reading and advertising public of the railway world, the publishers of the AMERICAN RAILROAD JOURNAL start out upon the fifty-ninth volume of the publication with renewed hope for its future. Having been established cotemporary with the introduction of railways in this country it has continued through an unbroken existence of nearly sixty years, and despite its venerable age it will keep alive with the times, and present a faithful reflex of railway progress.

RAILWAY TAXATION IN NEW JERSEY.

OUR sister State, New Jersey, is essentially a railway State. It is the possessor of more miles of railway in proportion to its area than any other State in the Union, and more in fact than any nation or governmental district in the world. The railway legislation which annually crops up at Trenton is therefore not a matter of surprise, and being the proud possessor of this tremendous mileage upon its fertile bosom it is not surprising, either, that New Jersey should endeavor to utilize it, which it has done most successfully; for up to a very recent period the railway taxation assessed by the State sufficed to meet all expenses of government, and it is only in very recent years that the worthy citizens of New Jersey have been brought to contemplate a State tax upon individuals and upon individual property as a possibility of the near future.

Necessarily, the appraisement and taxation of the railway interests of New Jersey gradually became a task of no small proportions, and last year an act was passed by the legislature, entitled "An act for the taxation of railroad and canal property," by which the labors of assessment and taxation were to be performed systematically; and the first annual report of the State Board of Assessors, appointed by the Governor under the provisions of this act, is before us. The report is an admirable one, and affords an interesting study of railway progress in New Jersey. When it is remembered that under the provisions of the act the Board of Assessors have also to determine the taxation of all insurance companies doing business in the State, as well as of all gas, electric light, telegraph, telephone and cable companies, pipe-line oil companies, and a host of miscellaneous corporate bodies, their industry and indefatigable attention to the work in hand are deserving of the greatest praise.

It is shown by this report and verified by experts, that, in the State of New Jersey there are in main line of railway, 1,871.237 miles; of double track, 473.402 miles; of sidings, 979.645 miles, making the total railway mileage of the State, 3,324.284 miles. Of this total there are 1,741.337 miles of steel rail, and 1,582.947 miles of iron rail. Doubtless each succeeding report will show an increase in the former and a decrease in the latter. The area of New Jersey being 7,815 square miles, there is one mile of railway to every 4.17 square miles of territory, and the nearest approach made to this railway mileage is in Massachusetts where there is one mile of railway to every 4.25 miles of territory.

The Assessors have determined the value of railway and canal property in the State, including franchise, as $195,525,963.87, being an average of $104,490 per mile, and upon this valuation a State tax of one-half of one per cent. is assessed, in addition to local taxes. The State nets from this tax the generous sum of $977,628.76 for its expenses of government, and thus the labors of the Board of Assessors are productive of good results.

The exhaustive manner in which the railway property of the State has been examined, subjected to careful appraisement and assessment, speaks well for the Board, and it is worthy of mention that every mile of railway in the State has been examined by careful surveys. That there are complaints on the ground of unjust taxation is not to be wondered at, when the magnitude of labor necessary to compile the report is considered, nor is it impossible that some portion of this complaint is well-founded, but the work of the Assessors has been intelligently and honestly performed, and the system of taxation now in vogue in New Jersey we should think would meet with general favor at the hands of its citizens, even if the railways are not entirely pleased.

RAILWAY INVENTIONS.

A CORRESPONDENT, who is also the inventor of a new railway appliance, writes us to inquire why it is that railway officials take so little interest in the examination of new inventions designed for railway use. We are not disposed to believe that railway officials are indifferent in the matter of examining new appliances, and we believe that true merit in railway inventions will sooner or later meet with recognition; but the fact is indisputably true that a large percentage of so-called railway patents are

not inventions in the truest sense. An invention is either the result of inspiration or of hard study to overcome certain obstacles, whereas many of the railway patents are hastily conceived appliances, whose sole *raison d'etre* is the fact that the patentee acquires proprietary rights of more or less value, principally less. Every month sees nearly two hundred patents taken out upon railway appliances, and out of these two hundred few of the devices patented are without serious drawbacks. Had the patentees taken a little more time to perfect their inventions, the percentage of valuable patented railway appliances would be greater; but the temptation is strong to apply for a patent as soon as the device is conceived, even in its most primitive form, and as a result railway officials are overrun with a vast amount of correspondence relative to "improvements" that are practically worthless; therefore, they cannot be blamed if they refuse inventors opportunities to test their patents, when a single glance of an experienced eye will demonstrate their worthlessness. Another point to be considered is the fact that patented devices are like babies—dearer to the authors of their being than to others, and attractions are visible to the inventor when contemplating his device that do not appear to the unprejudiced eye. Every month the JOURNAL publishes descriptions of a number of the most valuable railway inventions, and a still greater number are refused description through the poverty of the device itself. Yet the patentees of the latter class are by far the most importunate, and letters are constantly received offering us a small interest in the sale of certain appliances if we will publish the descriptions thereof. Doubtless the patentee marvels at our fatuity when we decline his princely offer, and thus refuse a fortune, but then he is a fond parent and his offspring is a thing of beauty in his eyes. Herein lies much of the difficulty, and it is not to be wondered at that railway officials decline to be bored by the inspection of a host of inventions that by no possibility could ever prove themselves of practical utility.

EDITORIAL NOTES.

THE famous Arctic explorer, Lieut. SCHWATKA, indulges in the hope that America may yet have a direct railway communication with Asia, *via* Alaska, Behrings Strait and Kamtchatka. It is his idea that a steam-ferry could connect Alaska with Kamtchatka during the Summer months, while in Winter, tracks could be laid upon the ice and an "all-rail route" constructed. While he was about it he should have bridged the strait, a large draw being provided for the passage of icebergs. Fish-horns should also be furnished to icebergs, upon application and presentation of testimonials of good moral character, by which the bridge-tender could be apprised of their approach. Doubtless these, as well as other minor improvements, will be suggested to the Lieutenant's mind in good season.

* * *

THE reorganization scheme submitted by the West Shore Committee has not met with universal satisfaction, but it is doubtful if a better one could have been devised. When the affairs of a road become so tangled as are those of the West Shore, it is much easier to criticize than to suggest, and if the unfortunate ones who have already invested their money in the road do not think the outside public will come to the front and purchase the new bonds, they had better make up their minds to purchase them on their own account and protect themselves. Grumbling won't mend matters.

* * *

CHINA is making rapid progress with her railways, and a recent non-progressive Mongolian who memorialized against the introduction of railways has been sat upon with small mercy and handed over to the Board of Punishment. This Board strikes us as an excellent thing, and we would like to see it introduced on this side of the Pacific. There are a number of assinine memorialists in this country who could be brought under its jurisdiction with beneficial effect.

MR. WILLIAM O. STODDARD has recently given to the public an interesting biography under the title of "Abraham Lincoln: The True Story of a Great Life." The career of the great American is traced from boyhood to his fall by the hand of an assassin, and as Mr. Stoddard was one of Mr. Lincoln's secretaries during the rebellion, the work bears with it an intimate personality not often found in the biographies of great men. Its illustrations are few, and not quite up to the standard of the work itself, but the book is one destined, we think, to meet with a large sale. It is published by Fords, Howard & Hulbert of this city. In form it is an octavo of 508 pages, and is sold at $2.75 cloth, and $3.50 half roan.

AN interesting budget of publications has been received from Cassell & Co., of this city, including their *Family Magazine*, *The Quiver*, and the *Magazine of Art*. These are always welcome visitors, and like old wine, improve with time. The *Magazine of Art* for May is a beautiful number, and contains some exquisite engravings, with accompanying letter-press. The *Family Magazine* and *The Quiver*, are, as usual, handsomely illustrated and offer most attractive reading.

"WATCH AND CLOCK MAKING," by David Glasgow, is the title of an interesting little volume published by Cassell & Co., in which the horological art is treated at length and illustrated by a number of diagrams. The author is the Vice-President of the British Horological Institute.

THE *Chicago Popular Monthly* continues to cater to the public as a cheap and interesting magazine for general reading, while the character of its contents is not lowered on account of its popularity.

Street-Railways.

American Street-Railway Association.

President.—Calvin A. Richards, President Metropolitan Railroad Company, Boston, Mass.

First Vice-President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

Second Vice-President.—Henry M. Watson, President Buffalo Street Railroad Company, Buffalo, N. Y.

Third Vice-President.—Edward Lusher, Secretary and Treasurer Montreal City Passenger Railway Co., Montreal, Canada.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fourth Annual Convention of the Association will meet in St. Louis, Mo., on October 21st, 1885.

THE PROBLEM OF CABLE TRACTION.

HAS there been too great precipitation in the matter of constructing cable roads, and is the cable road after all the successful solution of the traction problem? We ask this question in all earnestness, and while having devoted considerable space to the subject of cable traction, are as yet by no means sure that the cable road of to-day is the best form of street-railway that can be devised. That in many respects it possesses conspicuous advantages over roads employing horses as a motive power cannot be denied, but the construction of cable roads has been so rapidly entered into that it is only reasonable to suppose that many of their serious drawbacks have been overlooked and still remain to confront both the public and the builder. But a few months ago the construction of the cable road of the Philadelphia Cable Traction Company was begun, and now the following intelligence has been received from that city:

"The cable road of the Philadelphia Traction Company, constructed through twelve miles of the principal streets of the city, has been found to be radically defective, after a cost of $600,000 to the projectors, and one of the engineers engaged upon the system expressed the opinion that $250,000 would be required to correct mistakes and make the road practicable for traffic in cold weather. When the iron conduits through which the cable passes, were laid, iron rods were run through the stringers and bolted to the top of the conduits just below the slot where the grip passes down to the cable under the street. Every change of temperature has been found to affect the width of the slot and hinder the passage of the grip. Work has been begun to remedy this error; the ground must be torn up over the entire twelve miles of track laid, and substantial new ties and iron braces are to be inserted in place of the defective ones. The projectors of the road visited Chicago to examine the system in that city two years ago, but attempted improvements in this city which will now cost a quarter of a million to undo."

Probably the defects thus enumerated will be overcome, and the road put in perfect working order, but the outlay will be large and to a great extent unnecessary; for had sufficient thought and experiment been devoted to the consideration of the possible defects of the system beforehand, it is highly probably that a different system would have been adopted.

Still again the *Evening Post* of this city discourses at length upon the serious drawbacks of the cable system in Chicago, prompted to this course by the possible contingency of the construction of a cable road in this city, and especially upon Broadway. The *Post* has been the uncompromising opponent of the contemplated Broadway cable road, and speaks as follows of the disadvantages of cable roads:

"In the matter of the petition of the Cable Railway Company for permission to exploit the streets of New York, some interesting affidavits have been filed showing the objections to that system of street travel as developed by experience in Chicago. Before mentioning them in detail a few words upon the differences of conditions in the two cities will not be out of place. The city of Chicago when it adopted cable railways for a portion of its street travel was practically inhibited from adopting the elevated system by a provision in the State Constitution which declares that private property shall not be taken or *damaged* for public use without due compensation. This provision was believed to interpose an insuperable obstacle to elevated railways, since the compensation to be awarded by juries to property-owners along the lines might swell the cost to an amount far exceeding the cost of the structures themselves, and make the enterprises unremunerative from the start. Underground railways were likewise objectionable for the reason that the road-bed would be in all cases below the level of the lake, and would require constant pumping to keep them free from water. The city required, nevertheless, enlarged facilities for street transit, and only adopted the cable system as the only means for securing at once greater speed and additional accommodation. Neither of the difficulties which interposed themselves in the way of overhead and underground travel there, existed, or were supposed to exist, in New York when the elevated system was proposed here. Moreover, the streets assigned to the cable roads in Chicago were considerably wider than the ordinary streets of New York, affording more room for traffic on either side of the railway tracks. The streets of Chicago were also everywhere level and for long distances absolutely straight, in the crowded as well as the more open sections of the city.

"The first and most serious objection to cable railways is that the motive power is unintelligent, and therefore disregardful of obstructions in its course. Any disarrangement of the machinery which prevents immediate stoppage is liable to lead to a collision, or cause the loss of human life. Horses will stop or turn aside instinctively to avoid collision, but a cable-moved car stops for nothing except in obedience to the brake, which may be out of order or may not be applied with sufficient force or sufficient celerity by the driver. A horse will not run over a man voluntarily. A cable car will run over any number of persons or things with the uncontrollable impetuosity of steam. The momentum of the cable cars, as operated in Chicago, is about four times greater than that of any ordinary street car, the cable trains consisting usually of three passenger-cars and a "grip-car" which also carries passengers. The weight of this propelling force is sufficient to knock into fragments the most heavily loaded truck that can be moved by horse power. Casualities of this sort were frequent and the loss of life alarmingly great in Chicago when the cable cars were first put in operation in Chicago, but experience has taught both drivers and pedestrians to give the "grip-cars" a wide berth. In other words, the usefulness of the streets for ordinary travel has been seriously impaired by the introduction of these machines. Speed, in the less frequented portions of the city, has been obtained, but at the expense of room and security for ordinary traffic.

"Another difficulty of cable locomotion is that the breaking or derangement of a cable dislocates the whole system. Since such accidents are liable to happen at any time, horses must be kept in readiness at convenient stations. The economy of the cable system is greatly lessened by this requirement, and it is open to grave doubt whether there remains any route in New York upon which it could be applied with advantage in the mere matter of dollars and cents. In the lower parts of New York the curves in the streets are so frequent and abrupt that the cable system could not be worked even with the speed of ordinary horse-cars, and it is

here only that trains of cars could be filled. It may be said, indeed, that for New York at the present time the cable system is as far behind the age as the street-car and the omnibus were ten years ago. When we take another step in the way of rapid transit, let it be an improvement upon existing facilities, and not a doubtful experiment or a new obstruction to present means of travel."

We do not wish to place ourselves as opposed to cable roads, for such in fact is far from our true position. We have steadily maintained that the advantages of such roads, properly constructed, were great, and have published a series of articles on "Cable Road Construction" by the leading cable engineer of the country; but we certainly do discountenance the general "hurrah" with which the cable system is being pushed, and urge that a little more attention be devoted to overcoming obstacles of construction *before* instead of *after* the rails are laid. It appears to be a settled principle with cable road engineers, that every cable road must have some new feature, and generally must be constructed entirely on a new model. Well-known and successful methods of constructing cable roads have been put aside and every new road built is claimed to possess superior advantages over those previously constructed. It has been the aim of the builders to furnish a road, not so much with reference to its quality as to its novelty, and here would seem to be one trouble. If the builders would stick to what has been found good, and not build on the experimental fashion, the lapse of time would show the ways for overcoming difficulties at present existing; but so long as each builder constructs a different kind of road, so long will the obstacles increase instead of diminishing.

Furthermore, because a cable road meets with favor in San Francisco, for instance, and is in successful operation in that city, it does not necessarily follow that such a road would be suitable for Broadway in New York, or for similar thoroughfares in our leading cities. Location has much to do with the success of cable roads, and this perhaps is but one of a dozen questions to be considered before the construction of a cable road is entered upon. Cable traction is yet in its infancy, whereas it has been treated as a full-grown and developed system, and therefore to the question we propound, an affirmative answer may be given with considerable truth.

At the present writing there are an ample number of cable roads in this country on which experiments may be made with a view to overcoming such drawbacks as may from time to time present themselves, and there is no earthly benefit to be derived from constructing more cable roads on new and "improved" principles, unless these principles have lost a little of their "newness" in the way of previous experiment. An unmerited prejudice against cable roads may readily be awakened by a series of failures, and the growth of cable traction more injured than fostered by undue haste in the construction of new roads on new principles.

THE QUESTION OF RAILS.

BY AUGUSTINE W. WRIGHT.

[Written for the AMERICAN RAILROAD JOURNAL.]

I WAS much interested in the article on "Center-Bearing *versus* Side-Bearing Rails," from the able pen of Mr. A. J. Moxham in the February JOURNAL. Six or seven years past when laying a piece of track, I thought, "Now, if I retain the outside of my stringers in place, the track will be secure. The flange on the car-wheels prevents its becoming narrow-gage, and every vehicle that turns out of the tram tends to widen the gage; there is nothing in this city tending to narrow the gage." I therefore securely spiked cast iron angle-irons to the outside of the stringers, two on each cross-tie, and spiked the inside lower edge of the stringer to the cross-tie with six-inch cut spikes. This, I assumed, with paving in the horse paths, would hold the track to gage. Much to my surprise within three or four months I found the track wide-gage. Upon taking up some pavement, I found the stringer had turned on the top of the cast iron knee. The bottom had crowded in an inch or more. It is needless to say that ever since that date I have used four cast angle-irons upon each cross-tie, two small ones inside and two higher ones outside of the stringers. A heavily loaded street-car is, in Chicago, the greatest weight upon our tracks. At times it equals three tons upon each car-wheel. With our side-bearing rail, this pressure all comes outside of the center of the stringer and tends to tip it over. Then consider the effect of a heavily loaded four-horse truck in turning out of our track. The head of rail being one inch above the tram on which the wagon travels, the horses acting with a leverage equal to the distance of the end of the tongue from the forward axle, exert a force against the rails which must either spread them or lift the wagon and load above the head.

The extent to which heavy traffic seeks street-railway tracks is not generally appreciated. A paper I wrote some years since, "The Best Pavement for Horse-Railroads," contained the following: "On April 14th, 1881, I stationed a man with pencil and paper on North Clark street, between Elm and Division, for ten hours, from 7 A. M. until 12 noon, and from 1 P. M. until 6 P. M., with directions to carefully count every vehicle that passed, and note those whose wheels traveled upon the rails, those that used the sixteen feet of pavement maintained by the railroad company without being on the rails, and those that traveled outside of the sixteen feet. He reported 2,052 vehicles upon the rails (including 642 cars), 61 vehicles upon the sixteen feet aforementioned but not on the rails, and 53 vehicles outside the sixteen feet. In other words, that portion of the street maintained by the railroad company was used forty times, where the balance of the street was used once! The street was then paved with pine blocks from curb to curb. You will remember that this is at a point distant a mile and a half from the Court House, where the travel is relatively less. April 28th, the same man was stationed on Lincoln avenue near Webster, from 7 A. M. until 12 noon. He reported 367 vehicles as passing on the rails (including 185 cars,) 66 on the sixteen feet maintained by the railroad com-

pany, and 62 outside. The horse paths were paved with cobble-stone and the balance of the street with new cedar block pavement. From 1 P. M. until 6 P. M., the same day, he counted in front of Lincoln Park, where the horse paths were paved with cobble-stone—the street, exclusive of sixteen feet, consisted of soil in fine order after a shower of rain—788 vehicles using the rails (including 320 cars), 85 on the sixteen feet but not on the rails, and 97 outside. The sixteen feet was here used nine times to one outside."

Considered from different points of view, the question will be differently answered. So far as company horse-power is concerned, it must be admitted that the center-bearing rail is the one most free from dirt, and therefore requiring the least tractive force. Considered from a track standpoint, it is undoubtedly the best. If the head is not high, the vehicles do not exert the same force to spread the track in turning out. Mr. Moxham speaks of reversing the side-bearing rail, and thus having the tram come on the outside, then all the tendency would be to narrow the gage, and this would not interfere with the cars unless it became too narrow to carry the wheels. This construction was advocated in 1859, but so far as I know, never put in practice. When, however, this question is considered from a pavement point of view, the side-bearing rail is the best, unless the center-bearing is made with trams equally as wide. The steel or iron rail affords the cheapest possible wearing surface for the traffic that does seek the street-car track, and if the wheel does not travel on the rail, causes rapid wear and depreciation of the pavements. Everything taken into consideration, I believe that every street-railway company would buy the center-bearing rail, if permitted so to do by the various municipal authorities. I can add nothing more to the valuable and interesting article of friend Moxham.

THE LIABILITY OF STREET-RAILWAY COMPANIES FOR NEGLIGENCE.

BY O. S. BRUMBACK.

[A Paper read before the Convention of the Ohio State Tramway Association.]

THE liability of street-railroad companies for negligence, is an important question to all who invest in this species of property. From the very nature of their duties and property, street-railroad companies are peculiarly liable to answer in the courts. Traversing crowded thoroughfares, where people of all ages and conditions congregate and transact their daily affairs; expected to make fast time along avenues crowded with vehicles, and blocked with the commerce of a metropolis; with a thoughtless class of men (as a rule) for their servants; with limited facilities for guarding against prospective damages, and no means of taking precautions against the indiscretion of the old and the innocence of the young; and last, but by no means least, with the popular prejudice, both of courts and juries, against railroad corporations—the lot of a street-railroad company in court is "not a happy one." Liability of a railroad company for negligence is a broad theme, and widens into such a variety of cases—justice to the subject could only be done in a treatise of large dimensions. I can only hope, in the short time allotted me, to give a general idea—a bird's eye view, as it were—of the law of negligence in Ohio, and particularly as applied to street-railroads.

Negligence has been tersely and aptly defined in an English case as "the absence of care according to the circumstances,"[1] and more clearly in another case as "the omission to do something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs, would do, or the doing something which a prudent and reasonable man would not do."[2] And in a case in the United States Supreme Court, Justice Field said: "It (negligence) must be determined in all cases by reference to the situation or knowledge of the parties, and all the attendant circumstances. What would be extreme care under one condition of knowledge and one state of circumstances, would be gross negligence with different knowledge or changed circumstances."[3]

We thus see the question of negligence is largely a relative one, to be determined by the facts in the case. It is the province of the jury to find from the testimony what was the knowledge of the parties and the attendant circumstances, and the court will instruct the jury as to the effects of these facts in making out a case of negligence. Where there is no controversy as to the facts, of course there is no need of a jury, and the case is one of law for the court alone to decide whether the said facts make out a case of negligence.[4]

Having thus determined what negligence is and who determines it, we will pass to the question of liability for negligence, or what constitutes a case of negligence for which recovery may be had.

There is a well-known principle of the old English law engrafted upon our American jurisprudence of *respondeat superior*, which is to say, an employer holds out his agents as competent and fit to be trusted, and is liable for their acts within the scope of their employment.[5] This principle, when applied to negligence, gives us the general American doctrine, that a party guilty of negligence, or his employer, must answer in damages to the party injured, provided the injured party is not in fault in failing to exercise care himself.[6]

When a party contributes to his injury by failing to exercise ordinary care under the circumstances, the law justly concludes he is to blame himself, and will not permit him to recover for his own wrong; for certainly it would be hard to separate the wrong of the one from the wrong of the other.[7] This provision of the law is the chief bulwark of a railroad company in a battle in court. If the company can show the plaintiff was guilty of negligence himself, contributing toward causing his injury, it will have a complete defense. There is a limitation to this rule, however; in a case where the "negligence of the defendant is malicious, or so wanton and gross as to be evidence of voluntary and willful injury on his part, and the fault of the injured party is merely the want of ordinary care, it does not fall within the general rule—the faults not being of the same nature."[8] In a large proportion of damage cases there will be found contributory negligence, and it should be the first duty of the managers of a railroad company, in case of an accident, to immediately investigate if there are not witnesses who will testify to guilty negligence on the part of the party injured. But what constitutes guilty negligence? What care is necessary to avoid being negligent? The degree

of care necessary to be exercised, is an important feature in the eye of the law, and as before stated, depends upon the surrounding circumstances. It varies greatly, but we may say it must in all cases be at least *reasonable* or *ordinary* care. In others it must be more than ordinary—it must be *great care*, and in still others it must be *excessive*—the greatest care that can be exercised, if liability would be avoided. For convenience in considering these degrees of care that must be exercised, we will consider:

1. Liability of street-railways to the public for want of care; and

2. Liability of street-railways to their employés for want of care.

(*To be continued.*)

1. 5 Hurl. and N. 678.
2. 11 Exch. 784.
3. 15 Wall. 524.
4. 28 Ohio St. 340.
5. Ohio St. 207; 28 Id. 28.
6. 25 Ohio St. 88.
7. 2 C. S. C. R. 268.
8. 22 Ohio St. 20.

An Elevated Cable Road in Brooklyn.

AN important grant has recently been made by the Brooklyn Board of Aldermen, by which the Brooklyn & Long Island Cable Railway Company is awarded a franchise to construct an elevated cable railway from the bridge and from South Ferry to East New York. The main line will be in Atlantic avenue, and the bridge branch in Boerum place and Adams street. The companies interested in the organization (the Long Island and the Atlantic Avenue roads) are to unite with the city in seeking such legislative action as will remove steam from the surface of Atlantic avenue, as far east as Brooklyn avenue, except for freight-cars, and for these only from midnight to 4 A. M., after the elevated structure is built. The cable company is to construct the elevated road to Flatbush avenue within eighteen months, and to Brooklyn avenue within three years, under penalty of forfeiting to the city 7½ per cent. of the gross receipts of the part of the road in operation, a bond of $500,000 being given.

An Electric Railway in Baltimore.

THE Baltimore and Hampden Railroad, which is to be a suburban branch of the Union Passenger Railway of Baltimore, is in process of construction and is almost completed. The road starts from Huntington avenue and Oak street, Baltimore county, and passes through the villages of Mt. Vernon, Hampden and Woodberry. It is the intention of the company to use electricity as a motive power, modeled on the system in use on one of the long piers at Coney Island. A motor, independent of the cars, is being made to try the experiment, and if it is successful it is likely that the future motors will be part of the cars. The length of the new road is 2¼ miles and it is expected to be soon ready for use.

Coal Consumption by the Brooklyn Bridge Railway.

FROM a recently prepared statement it appears that the average coal consumption per day, for car service on the Brooklyn Bridge is six tons, which does the moving of the 1½ in. cable, 11,450 feet long and weighing 40,075 lbs., at a speed of ten miles per hour for 20 hours per day, and keeps from 10 to 20 cars, weighing 10 tons each, constantly moving, the total number of car round-trips per day being 1,200. The power required to move the cable and machinery alone, without cars, is 35 horse-power, which corresponds to a tensile strain of 1,312 lbs., or about 66 lbs. per ton weight of cable. Allowing the rolling friction of the cars to be 6 lbs. per ton, and nothing to be lost by grade resistance (since the cars remain attached to the cable in descending and give up the power lost in ascending) the average power required to keep the cars in motion is 14.52 h. p. additional, or a total of 49.52 h. p., from which it results that the coal consumption per horse power per hour is only 1.36 lbs., which is certainly very low, calculated to raise a suspicion that the rolling friction of the cars is not quite so high as assumed, especially as no allowance has been made for the heavy average load of passengers.

The Louisville City Railway Company.

THE stockholders of the Louisville City Railway Company held their annual meeting on the 12th inst., and elected as directors Maj. Alex. H. Davis, St. John Boyle, E. C. Bohne, H. B. Hanson, Theodore Harris, Alex. P. Humphrey, and H. H. Littell. The directors organized and elected Maj. Alex. H. Davis, president; St. John Boyle, vice president; R. A. Watts, secretary and treasurer; H. H. Littell, superintendent. A dividend of three per cent. from the earnings of the past six months, payable April 1, was declared.

An Oil-Burning Street-Car Motor.

A MOTOR to burn earth oil is being constructed by Messrs. Merryweather, of London, England, for the Rangoon Steam Tramways. Previous experiments in this direction having proved satisfactory, a large saving in the cost of fuel is anticipated.

STREET-RAILWAY NOTES.

THE American Electric Railway Co. has filed certificates of incorporation in New York, with Cyrus W. Field and others as corporators. The company is organized to build, own, sell or let locomotive engines to be operated by electricity, and also cars and other railway machinery.

THE Brooklyn (N. Y.) courts have decided that the "bobtail" cars of that city must be provided with conductors, in accordance with an ordinance to that effect passed by the common council.

A NEW cable road is to be constructed in Cincinnati, three miles in length, extending from the city to Walnut hills, up a heavy grade. The road is expected to be opened for traffic by July 1st.

THE Montgomery (Ala.) Street-Car Co., having organized and bought material, will proceed with the construction of their road.

THE description of a new cable grip is published in the department of New Inventions of this issue of the JOURNAL.

New Inventions.

Colby's Sleeping-Car.

JAMES F. COLBY, of Buffalo, N. Y., is the inventor of a sleeping-car which is herewith illustrated and described. It is the object of the inventor, first, to provide such an arrangement of seats in a railway-car that they may be made of sufficient length to enable passengers to lie down at full length on them; second, to provide such an arrangement of transverse seats in a railway-car that one set will occupy one side of one-half of the car, and the other set will occupy the opposite side of the other half of the car, thus effecting an equal distribution of the weight; third, to provide, in addition to the transverse seats in the car, seats running in a longitudinal direction, which are also of sufficient length to enable a passenger to lie down at full length, and arranged relatively in the same manner as the transverse seats; and, fourth, to provide a support for the seat, a portion of which will also serve the purpose of a head-rest.

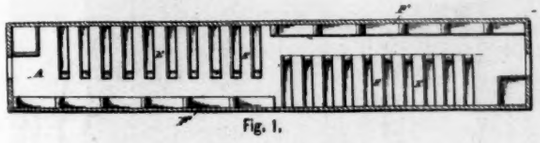


Fig. 1.

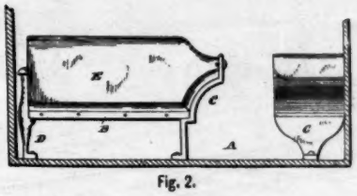


Fig. 2.

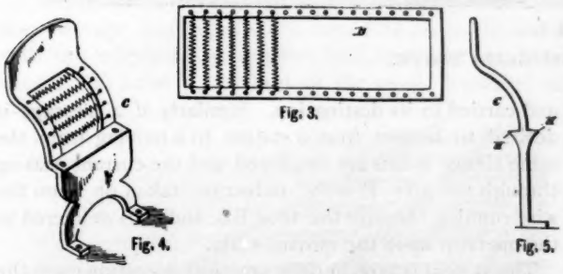


Fig. 3.

Fig. 4.

Fig. 5.

COLBY'S SLEEPING-CAR.

In the accompanying cuts, Fig. 1 represents a plan view of the flooring of a railway-car, showing the improved manner of arranging the seats; Fig. 2 a cross-sectional view of a portion of the car, showing one of the transverse seats in front elevation and one of the longitudinal seats in end elevation; Fig. 3 a plan view of the seat-frame with the upholstering removed; Fig. 4 a detail perspective view of the support and head-rest, and Fig. 5 a modified form of the head-rest.

A is a car-flooring, which may be of the ordinary or any approved construction, on which is mounted two sets of transverse seats and two sets of longitudinal seats. The former of these seats are placed so that one set will occupy one side of one-half of the car, and the other set will occupy the opposite side of the other half of the car. The object of this arrangement is to afford room for seats of such length as to enable persons to lie down upon them at full length, and also to effect an equal division of the weight on either side of the car. The longitudinal sets of seats are arranged relatively with the other in the same manner as the transverse seats are relatively arranged. The several seats of each set in the longitudinal series are contiguous one to the other. The transverse seats are constructed of a frame B, of metal or of wood, and provided with a series of apertures. Secured to these apertures are a series of transverse curled or spiral wire springs, which collectively form a support for a mattress or cushion.

C refers to the end pieces of the respective seats, the same being preferably constructed of cast-iron. The lower portions of these pieces constitute the supporting-legs for one end of the seats, and the upper portions constitute head-rests. The portions forming head-rests are curved upwardly, so as to bring them in a plane above the seat proper, as indicated, so as to form a convenient and comfortable support for the head, and to lengthen practically the seats by reason of their overhang. They are provided with a series of apertures, to which are connected the springs, as above described in reference to the frame proper of the seats. This piece C, is further provided, at the upper end of the part which constitutes the supporting-legs, with an offset adapted to receive and sustain the adjacent end of the frame B. The opposite end of this frame is supported by a leg D, the upper portion of which terminates in an arm of any approved configuration. These seats are provided with the usual backs E, the arms by which they are pivotally connected with the seat being in this instance attached to a convenient part of the head-rest and to the seat-arm. If desired the transverse seats could be placed back to back, thus forming compartments, which by means of curtains could be shut off from the rest of the car.

F refers to the longitudinal seats, the frames of which are constructed in the manner above described. The head-rests are also constructed in the same manner, save that in this instance they are provided with lugs H, instead of with the offset, whereby the supports for the frames are provided.

As represented in Figs. 1 and 5, it will be observed that the head-rest of each horizontal seat overhangs the foot end of the next succeeding seat, thereby economizing in space and utilizing all the available room in a car.

The lower portions of the pieces which constitute the head-rest also form, as above described, supporting-legs for the longitudinal seats. These legs may be of any desired configuration, so as to be secured to the flooring or to the sides of the car, as represented in Fig. 2. The cushions, which are fitted upon the seats, are supported by the springs secured to the frame of the seat and to the head-rest, and are of such configuration as to cover it evenly and smoothly.

From the above arrangement it will be seen that the seats can not only be made sufficiently long to accommodate persons in a recumbent position, with their weight equally distributed over the car, but at the same time ample room remains for a proper passage-way or aisle.

Phelps' Induction Telegraph System.

LUCIUS J. PHELPS, of New York City, is the inventor of a system of telegraphic communication to and from moving trains, that is already in practical operation upon one road, and seems destined to be generally employed. The inventor, who is a well-known electrician, has ingeniously made practical use of a feature of electrical communication that has hitherto been regarded as a serious drawback, illustrating the adage that "out of evil cometh good." It has long been known that if two wires are extended parallel, near to but not in actual contact with each other, and a current of electricity be sent through one of the wires, a momentary current will be excited in the other wire, flowing in an opposite direction to that in the first. This peculiar phenomenon has been particularly noticed in telephone wires, and much confusion has resulted from the intermingling of currents from wire to wire. Much time and ingenuity have been expended by inventive electricians to overcome this feature of electrical communication, known as *induction*, but Mr. Phelps is apparently the first to perceive in it a positive utility.

With the knowledge of this phenomenon Mr. Phelps has devised a telegraphic system, properly called the *induction system*, by which telegraphic messages may be sent and received to and from railway trains moving at any speed. The accompanying cuts illustrate the construction and operation of the system.

Fig. 1 represents a smoking-car of the usual construction, with the device attached; Fig. 2 the electrical apparatus stationed in one corner of the baggage-compartment of the car, and Fig. 3 a section of the track with the secondary wire encased in a wooden trough or tubing.

Under the car A, runs a section of gas-pipe BB, supported by rods and extending the distance between the forward and rear trucks. This pipe lies parallel to the track and at a distance of about seven inches from it. Through this pipe extends a continuous wire, which passing up into the car, makes ninety convolutions, and is connected to the telegraphic apparatus C, shown in Fig. 2. A continuous wire of 1½ miles is thus furnished, or nearly ¾ of a mile of wire directly under the car. Between the rails DD, D'D', is laid a wooden trough or tubing EE, extending the whole length of the track, or for so long a distance as the system is desired to operate. Through this trough or tubing, runs a wire F, connected with telegraphic apparatus at any number of stations along the line. In brief, the system is now in condition for practical operation, the various modifications and devices for overcoming obstacles being of secondary importance, though they will be described later. The operation of the induction system is as follows:

It being desired to send a telegraphic dispatch from the train, the operator transmits it through the wire running through the tube BB, under the car. By the principle of electrical induction a current is excited in the wire F, running through the wooden trough EE, between the rails, and the message is duplicated upon this wire and carried to its destination. Similarly if a message is desired to be sent from a station to a moving train, the same simple means are employed, and the current passing through the wire F, is by induction taken up upon the wire running through the tube BB, and thus delivered to the operator upon the moving train.

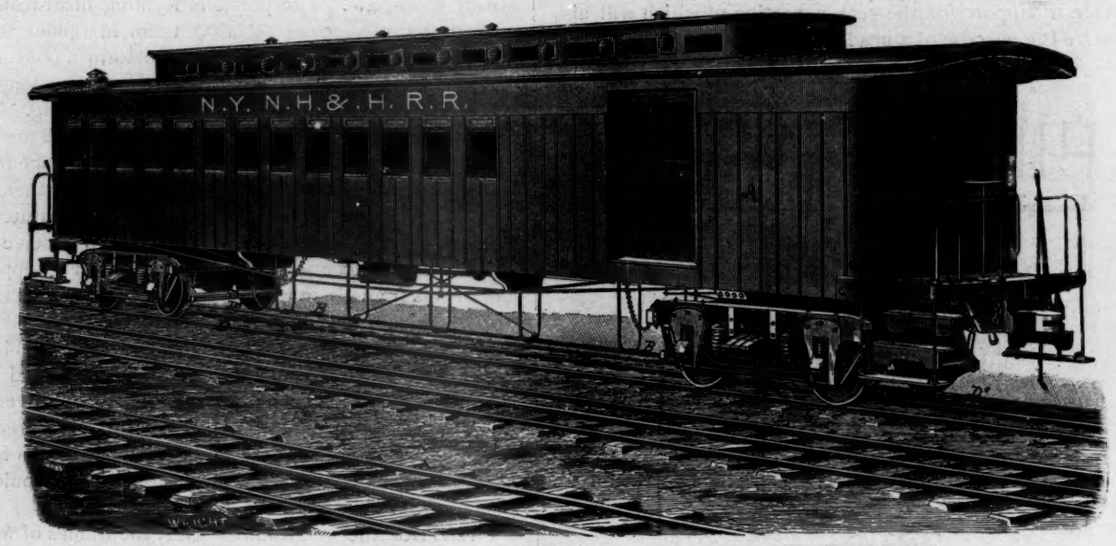


Fig. 1.

PHELPS' INDUCTION TELEGRAPH SYSTEM.

The system is now in daily practical operation upon the branch of the New York, New Haven & Hartford R. R., extending from Harlem to New Rochelle, a distance of twelve miles, and two representatives of the AMERICAN RAILROAD JOURNAL, upon the invitation of the inventor, examined the system thoroughly, both in its construction and operation. Upon entering the car, the apparatus for the transmission and reception of messages was seen situated in one corner of the baggage compartment. It occupies but little space, and closely resembles the ordinary apparatus for the transmission of telegraphic dispatches. After the train had left the Harlem station and was running at a high rate of speed, the following message was dispatched to the office of the JOURNAL: "On

board train 15 New Haven Road. Message sent by Phelps process. Not back to-night. Answer." The operator dispatched the message and in order to secure correctness it was telegraphed back from the receiving station, situated a few hundred feet from the Harlem depot. The inventor has found it advisable to employ the telephone as a means of communicating the message,

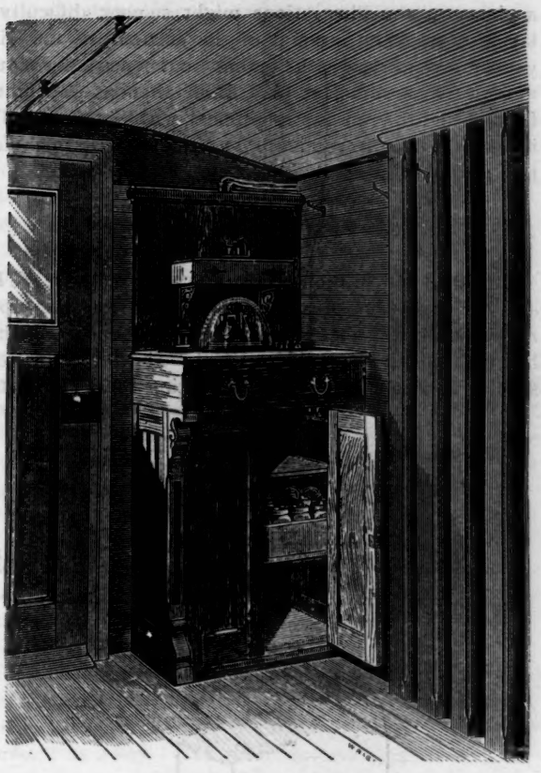


Fig. 2.

PHELPS' INDUCTION TELEGRAPH SYSTEM.

in combination with the usual Morse system, and when the message was repeated it could be distinctly heard with the telephone transmitter held some distance from the ear. It came in the form of the usual "buzzing" so

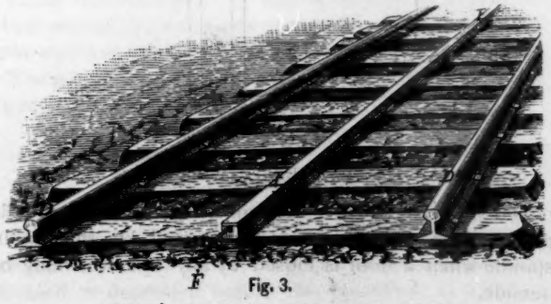


Fig. 3.

PHELPS' INDUCTION TELEGRAPH SYSTEM.

familiar to all who have used the telephone, and once again the inventor has made use of a hitherto objectionable feature to accomplish the desired ends. Unfortunately there was not sufficient time for a message to be returned from the JOURNAL office, but the message was delivered thereat within fifteen minutes after its dispatch, demonstrating the reliability and accuracy of the system.

The inventor has provided for every contingency, and nothing appears to have been overlooked in the perfection of his system, though doubtless minor improvements will be introduced from time to time. The wooden trough or tubing between the rails is of cheap and simple construction, and provision is made for bridges, switches and turnouts, by passing the wire through rubber tubing under the crossing rails, and under the draws of bridges. In order to prevent the trough from being injured at highway crossings, at these crossings the wire is passed through a stout iron pipe, and thus preserved from harm.

At the semi-annual meeting of the Association of American Railroad Superintendents, held in Richmond, Va., on April 15th, Mr. Wm. H. Stevenson, the president-elect, read an interesting paper explaining the operation of the Phelps' Induction System, and warmly indorsing it.

The utility of this invention must be apparent, and several roads are already in negotiation for the use of the system. The induction telegraph has been patented, and is now entirely controlled by the Phelps Induction Telegraph Company, of 13 Park Row, New York City.

Miller's Railway Rail-Joint.

ISAAC J. MILLER, Jr., of Cincinnati, O., is the inventor and patentee of a railway rail-joint, which is herewith illustrated and described. It is claimed to be quite dis-

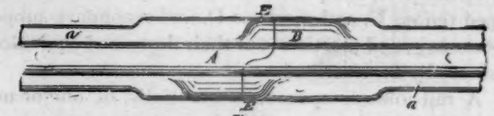


Fig. 1.

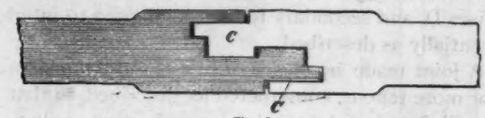


Fig. 2.

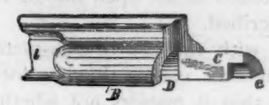


Fig. 3.

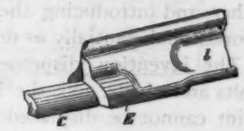


Fig. 4.

Fig. 5.

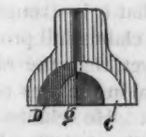


Fig. 6.

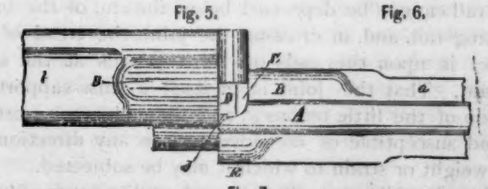


Fig. 7.

MILLER'S RAILWAY RAIL-JOINT.

tinct from any railway rail-joint heretofore patented, and to provide for a continuous rail, firmly interlocked, without the usual transverse openings at the joints of rails. The accompanying illustrations will enable one to understand the inventor's claims, which are as follows:

1. A rail having a flanged mortise formed in the under side of one of its flanges B, at the end of the rail, and a

fitting-tenon projecting from the base of the opposite flange and forming one-half of an interlocking rail-joint, substantially as described.

2. A rail having the tenon C, projecting from the base of one of its flanges, and adapted to interlock with a flanged mortise formed in the flange of an abutting rail, substantially as described.

3. A rail having the flanged mortise D, formed in one of its flanges at the end of the rail, and adapted to receive and interlock with a tenon projecting from the opposite flange of an abutting rail.

4. A rail-joint formed in the rails, consisting, essentially, of the tenons C, and flanged mortises D, formed at the ends of the rails, and adapted to interlock reciprocally each with the other, substantially as described.

5. A rail-joint formed of tenons and mortises attached to and formed in the flanges of the rails, with the web and tread of the rail terminating in two reverse-curved abutting lines upon each side of the center of the tread, substantially as described.

6. A rail-joint composed, substantially, of the tenons C, and mortises D, formed upon the base of the flanges of the rails, of segmental shape, each chiefly outside of the central line of the tread of the rail, and forming an interlocking shoulder *d*, to prevent the end removal of the rails, substantially as described.

7. A rail-joint composed, substantially, of the quadrant-shaped tenons C, and mortises D, and secondary supporting-tenons *g*, and mortises *e*, or their described equivalents, substantially as described.

8. A rail-joint composed, substantially, of one or more tenons C, having a secondary mortise *e*, one or more mortises D, and secondary tenons *g*, adapted to interlock, substantially as described.

9. A joint made by means of one or more mortises and one or more tenons, constructed as described, so that the parts will interlock by turning one rail at an angle to the other and introducing the tenon in the open side of the mortise, substantially as described.

The invention dispenses with the use of fish-plates, bolts and rivets, and the inventor claims that the lock-joint cannot be displaced; that it matters not whether the joint rests upon the cross-ties or occurs between them, and that it is stronger than any other part of the rail.

He claims full provision for expansion and contraction, and, yet, that the rails cannot creep, because the spikes driven in the ties act as locks against the flange at the joints. He claims smooth riding, because the end of one rail cannot be depressed below the end of the interlocking rail, and, in crossing the joint, the tread of the wheel is upon the ends of the two rails at the same instant. That the joint is in itself a truss-support by reason of the little tenons *g*, and the reciprocal mortises *e*, and susceptible of no movement in any direction by the weight or strain to which it may be subjected.

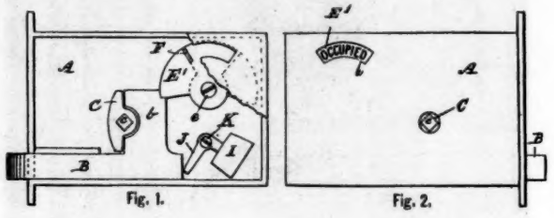
That the rails are easily laid and readily removed when the tenons are in the same flange of the rail, the mortises being in the opposite flange, by simply rolling the rail over as illustrated in Fig. 7, which is done by slightly elevating the ends of adjoining rails and lowering the rail to be removed.

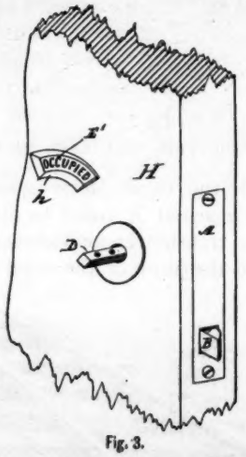
But, while the rails are easily laid when the tenons are in opposite flanges, yet, a single rail cannot be removed, because one end of the rail is constructed to turn one way while the other end is formed to turn in the opposite direction. He claims a great advantage in this manner of laying rails across bridges and in dangerous places or where the track might be maliciously tampered with, because, to remove the rails, the work must commence at one end of the section of track so laid.

The two kinds of rails interlocking, part of the track may be removable and the other part immovable. While a glance at the illustrations might suggest difficulty in laying a track, on account of the accuracy of the joint, yet the inventor says, the tenons commence entering the mortises with sufficient play, filling them as the joint is formed and the rail is straightened with the track. The inventor is open to receive propositions for the manufacture of the rails.

Pearson's Indicator-Lock.

CHARLES and WILLIAM PEARSON, of Webster, N. H., are the inventors of an indicator-lock for use upon railway-cars, steamboats and upon hotel doors, which is herewith illustrated and described. The invention consists of a certain device for preventing the sliding latch





PEARSON'S INDICATOR-LOCK.

of a door, or the rocker through which the knob-spindle passes, from being moved or operated by the knob-spindle when a door is closed by any one who may be outside.

In the accompanying cuts, Fig. 1 is a side view of a lock having a portion of the housing broken out, exposing the device; Fig. 2 shows the reverse side of the lock, and Fig. 3 a portion of a door-stile in perspective, having mortised therein the improved fastening.

The case or housing A, is provided with a sliding bolt or latch B, having a finger *b*, against which a rocker C, will rest. This rocker is provided with a square hole *c*,

through its center, into and through which the square knob-spindle D, is passed.

In order that a person within may be able to prevent those outside from turning the knob-spindle and thus gaining entrance, a wheel-section E′, is placed within the case or housing A, hung on a pivot or screw *e*, so adjusted that it may be readily rotated to bear against the back part of the finger *b*, and thus prevent the latch B, from being moved by the rocker C, and knob-spindle D. The wheel-section E′, will be limited in its movement, the distance being determined by a thumb-piece or button F, which may be secured to the part E′, and pass out through a slot *a*, in the housing A, this slot being made the proper length to allow sufficient movement for the wheel-section E′. The slot *a*, will be made on a curve the radial center of which will be the pivot or screw *e*. Another slot may be formed on the opposite side, and conveniently utilized for the display of some such word as "engaged," "locked," or "occupied," as shown in Figs. 2 and 3, for use upon doors in hotels, state-rooms or railway-cars. The word may be so placed upon the wheel-section E′, as to show through a slot *h*, in the outside of the door H, opposite to the slot in the housing, when the wheel-section E′, is placed, as shown by full lines in Figs. 2 and 3; but when the wheel-section has been rotated to the position shown by dotted lines in Fig. 1, the latch B, will be free to move, and may be operated either from the outside or inside of a door by means of the knob, and nothing will be seen in the slot *h*, but the plane surface of the wheel-section E′. The slot *h*, cut in the door H, should be beveled on its sides and ends, as shown in the cuts, and a glass plate may be placed over the slot.

It may sometimes be desirable to be able to lock or fasten a door on the outside, in which case the construction of the part E′, may be so changed that it may be operated by a key. The wheel-section may also be furnished with a notch, as in the case of a bolt, in which the key may operate. The latch B, may be held so as to project outside the door, as shown in the cuts, by some suitable spring; or a weight I, may be attached to a right-angled lever J, fulcrumed at K, and this lever operate against the latch B, and accomplish the same purpose as a spring.

From this description it will be readily seen that the wheel-section E′, serves two purposes—viz., that of an annunciator and a fastening for the latch B.

The patent is now in the hands of the American Patent Agency, of Cincinnati, O.

Sisum's Cable-Railway Grip.

WILLIAM H. H. SISUM, of Brooklyn, N. Y., has recently invented an improvement in grips for cable-railways for elevated or depressed roads, the operation of which is shown in the accompanying cuts. The object of the improvement is to provide in a simple and effective manner for gripping the rope from a car, so that the car will, with slight power, be gradually started and afterward, when high speed is attained, positively connected with the rope.

The maximum of power required upon any given railway in which a cable is used for carrying the motive power, is one sufficient to start from rest into motion all the cars on the line loaded with the average load. To do this with certainty and safety, requires the use of very strong cables, and immense and powerful engines, rendering it commercially impracticable. This grip was designed to overcome that difficulty by multiplying the power at the moment of starting, when it is most needed.

Fig. 1 is a plan of a car-truck furnished with mechanism embodying the improvement; Fig. 2 a longitudinal section of a portion of the same, taken on the plane of the dotted line *x x*, Fig. 1; Fig. 3 a transverse partial section of the same, taken on the plane of the dotted line *y y*, Fig. 1; Fig. 4 a sectional view of a portion of the

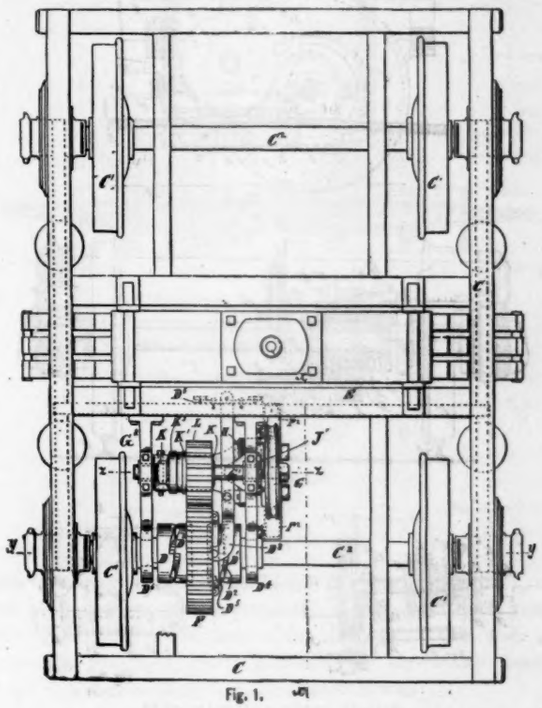


Fig. 1.

SISUM'S CABLE-RAILWAY GRIP.

latter, taken on the plane of the dotted line *z z*, Fig. 1, and Fig. 5 is a transverse section showing certain parts.

A designates rails on which the car travels. They may be of any construction, and laid in the usual or any other approved manner; B an endless rope or cable, which travels between the rails, suitable pulleys being employed to guide it, and any suitable means being used to drive it; C the frame of a car-truck, C′ the wheels thereof, and C^2 the axles of the wheels. The wheels are rigidly affixed to their axles, as is usual in railway-cars. The axles may be journaled in the truck-frame in any suitable manner.

On one of the axles C^2, are rigidly fastened two clutch-pieces D D′, having reversely-arranged ratchet-teeth. Between these clutch-pieces D D′, a clutch-piece D^2, is mounted on the same axle in such manner that it may be slid longitudinally into engagement with either of the clutch-pieces D D′. At its ends the clutch-piece D^2, is provided with ratchet-teeth arranged reversely to the ratchet-teeth of the adjacent clutch-pieces D D′, so that when rotated in either direction it may be engaged with

one or the other of the clutch-pieces D D′, to rotate the same, and consequently the axle to which they are affixed, either one way or the other, as may be desirable.

A lever D^3, is fulcrumed to a fixed bracket arranged on a bar D^4, here shown as supported at one end by a cross-bar E, sustained from the journal-boxes, and at the other by the adjacent axle C^2. One end of this lever is forked or bifurcated, so as to embrace a hoop D^5, which internally is provided with a circumferential groove engaging with a circumferential rib on the clutch-piece D^2. The bifurcated end of the lever is pivotally secured to the hoop by pins or screws passing through it and entering the hoop. The other end of this lever may have com-

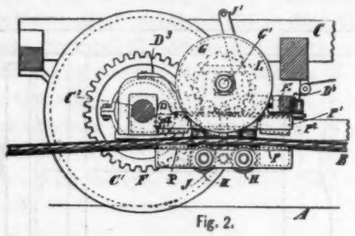


Fig. 2.

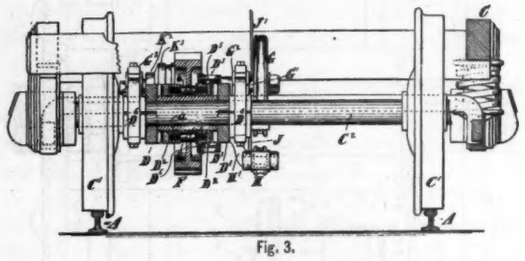


Fig. 3.

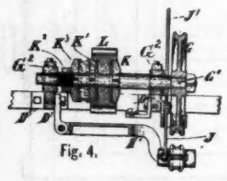


Fig. 4.

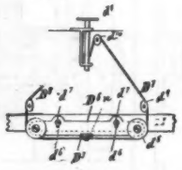


Fig. 5.

SISUM'S CABLE-RAILWAY GRIP.

bined with it any suitable device whereby a swinging or oscillating motion may be imparted to it. By oscillating the lever the clutch-piece D^2, may be shifted longitudinally, and, owing to the manner in which the lever is connected to this clutch-piece D^2, the lever will not interfere with the rotation of the clutch-piece.

F is a gear-wheel, which is arranged on the same axle as the clutch-pieces D D′, and between said clutch-pieces. This gear-wheel is not affixed to the axle so as to turn therewith, but may turn thereon freely. It is, however, connected to the clutch-piece D^2, so as to turn in unison therewith. As here shown, the gear-wheel has a long hub *a*, extending from each side of it. The clutch-piece D^2, is made in two sections, arranged on the hubs one on each side of the gear-wheel, and bolts *b*, extend into the two sections of the clutch-piece and pass loosely through the gear-wheel. In effect, therefore, a single clutch-piece D^2, is made, having two sets of ratchet-teeth, and although it is arranged directly upon the hub of the gear-wheel, yet it is indirectly supported by the axle upon which the gear-wheel is arranged. These parts may be combined in other ways to attain the same result.

G designates a grip-pulley, which is rigidly affixed to a shaft G′, journaled in bearings G^2, erected one upon the bar D^4, and another on a similarly-supported bar D^6. It will of course be understood that the bars D^4 D^6, are supported on the axle C^2, in such manner that they will not interfere with the rotation of the latter.

H designates grip-pulleys arranged so that they will be approximately in the same vertical plane as the grip-pulley G, and having their shafts supported at both ends in a bar carried by a lever H′, that is hung on a bracket D^7, extending from the bar D^6, as shown in Fig. 4. If necessary, the bearing of the pin which connects this lever to the bracket may be elongated to prevent the pulleys from being moved materially out of the plane of the pulley G, when the lever is swung or oscillated. The lower end of the lever H′, is connected by a link J, to a bell-crank lever J′. The lever J′, is fulcrumed to the bar D^4, and may have its upper end fastened to a cord or chain connected with a windlass. The turning of the windlass will then operate the lever and cause it to raise or lower the lever H′. When the lever H′, is raised, the pulleys H, will be drawn up into a position in which they will bear tightly upon the endless rope or cable and cause the latter to bear forcibly against the pulley G. The lever H′, will descend by gravity when the pull or strain on the lever J′, is relaxed.

The shaft G′, has mounted on it a gear-wheel L, that engages with the gear-wheel F. The gear-wheel L, is not rigidly secured to the shaft G′, but is clamped thereto by friction-plates K K′, which are locked on the shaft so that they will turn therewith. One of these friction-plates K, abuts against a shoulder on the shaft, and the other K′, is free to slide lengthwise to the shaft. The plate K′, may be forced toward the plate K, by a nut K^2, screwed on the shaft and acting against a plate K^3. Between the plate K^3, and the plate K′, is interposed a piece of india-rubber or analogous material. The plates K K′, are faced with leather or like material. By manipulating the nut K^2, the wheel L, may be secured more or less forcibly to the shaft G′. The wheel L, can be allowed to slip on the shaft under very severe strains. On the bar in which the rollers H, are supported are fixed grippers P, and on a bar P′, above the former bar, are affixed corresponding grippers P^2. The bar P′ may be secured to the bar D^4. The grippers P P^2, may be made of wood or like material, or metal.

To cause the car to derive motion from the endless rope or cable, the clutch-piece D^2, is shifted into engagement with the clutch-piece D, and the lever H′, is canted to cause the pulleys G H, to grip the endless rope or cable. The grip-pulleys will then be caused, by the rope or cable, to rotate. Thereupon the gear-wheel L, transmits motion through the gear-wheel F, to the axle on to which the gear-wheel F, is affixed. The grip-pulleys continue to act in this way until the gear-wheel F, has acquired its maximum speed. When this gear-wheel has attained such speed, it rotates with sufficient rapidity to cause the clutch-piece D, to move faster than the clutch-piece D^2, whereupon the clutch-piece D^2, will be thrown out of engagement with the clutch-piece D. The motion of the car will have been gradually augmented, so that by this time its momentum will be such that its drag on the rope or cable will be insufficient to cause the rotation of the grip-pulleys. The lever H′, may now be swung up

still further, to cause the grippers P^2, and the grippers P, to grip securely the rope or cable.

When the car is to be stopped, the lever H′, will be lowered, and brakes of the usual or any suitable kind are applied to the wheels of the car. When the car is to be propelled in the reverse direction upon another portion of the endless rope or cable moving in the opposite direction to that of the portion to which the car was formerly fastened, the clutch-piece D^2, is shifted into engagement with the clutch-piece D′, and the lever H′, is raised to cause the endless rope or cable to be gripped, as before.

D^6 is a latch-bar, whereby the lever D^3, is normally kept in such position that the clutch-piece D^2, will be maintained by it out of contact with the clutch-pieces D D′. The latch-bar has at or about its middle a notch *n*, which, when the bar is in a horizontal position, engages with the lever D^3, and thus secures it in position. The latch-bar is provided with approximately-vertical slots d^6. Screws d^7 pass loosely through the slot d^6, and enter the bar E. The latch-bar is therefore hung on the screws d^7, in such manner that either end may be raised, the latch-bar meanwhile turning on the screws d^7, which is the further from it. When either end of the latch-bar is thus elevated, the notch *n*, of such bar will be disengaged from the lever D^3, whereupon the latter can be shifted.

Provision is made for raising the latch-bar D^6, and shifting the lever D^3, by one motion. D^7 is a cord or equivalent device, which is secured at one end to the lever D^3. From the lever D^3, it passes around a pulley d^8, on one end of the latch-bar, thence around a pulley d^9, which will be supported on a fixed part of the car-truck, thence around another pulley d^{10}, arranged on the car-truck, and is finally attached to a push-piece d^{11}. By depressing the push-piece d^{11}, the latch-bar will be raised and the lever D^3, pulled over. A cord D^8, passes from the other end of the latch-bar around pulleys to another push-piece, whereby the last-mentioned lever may be operated. After pressure is removed from the push-pieces the latch-bar can descend to its normal position.

When the clutch-piece D^2, is thrown out by either of the clutch-pieces D D′, the lever D^3, will be swung into a central position, and then will engage with the notch *n*, of the latch-bar.

Leech's Car-Coupling.

JOHN F. LEECH, of Allegheny, Pa., is the inventor of an improved car-coupling, which is herewith illustrated and described. It consists of two similar cylindrical draw-heads and a removable coupling-bolt. The cylindrical draw-head is suspended from the bottom of the car in the usual way. When the cars come together, the two draw-heads, which on all rolling stock project somewhat beyond the buffers, meet and yield to the motion of the cars until the coupling-bolt resting in one draw-head is automatically, by concussion and retreat of the draw-head, thrown into place in the other draw-head and the coupling is completed.

The draw-head consists of a cylinder having on top a longitudinal slot of sufficient size for the reception of the enlarged head of the coupling-bolt, and a smaller slot extending from the edge to below the center of the cylinder-head, perpendicular to and communicating with the upper longitudinal slot. In size it corresponds to that of the shank of the coupling-bolt. A section of a sphere projects from the center of the head-plate on the inside, through which the slot in the head-plate is continued. The draw-head is provided with the usual drainage-opening. The coupling-bolt consists of a shank having at each end an enlarged head concave on the inner side, so as to fit over the hemisphere on the inside of the draw-head, thus forming a ball-and-socket joint. •In coupling, the bolt is dropped by means of a chain attached to one

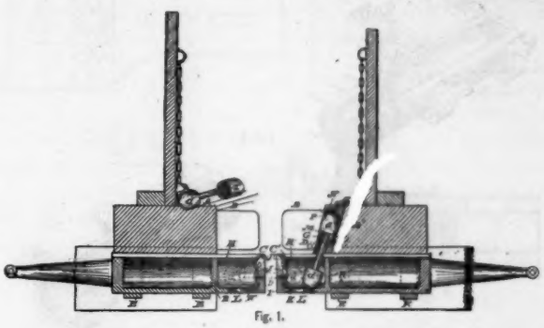


Fig. 1.

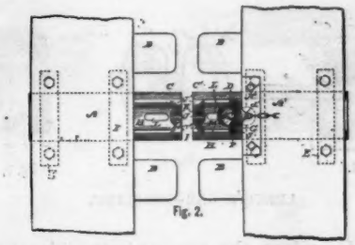


Fig. 2.

LEECH'S CAR-COUPLING.

end of it into the large slot of the draw-head, where it remains in a more or less perpendicular position, one head resting against the bottom of the draw-head, the other in a pocket provided for it immediately above the draw-head in the cross-beam of the car-platform.

In the accompanying cuts, Fig. 1 is a view in section of the two draw-heads and bolt prior to coupling, the position of the pin when coupled being indicated in dotted lines; Fig. 2 a top plan of the same; Fig. 3 a view in perspective of the draw-heads and bolt in place for coupling; Fig. 4 a view, partly in section, of the bolt; Fig. 5 a plan view of the inner side of the head-plate of the draw-head in detail, and Fig. 6, a view of the receiving-pocket for the bolt-head.

A A′ are the car-platforms, B B B B the buffers, C C′ the draw-heads, and D the coupling-bolt. E E are brackets by which the draw-heads C C′, are suspended from the bottom of the car, and G G′ the receiving-pockets for the head *d*′, of bolt D. In draw-head C, H is the upper longitudinal slot for receiving the head of bolt D. I is the head-plate, having the slot J, flaring at the top J′, where it joins slot H, so as to guide pin D, more readily into place. K is the section of the sphere projecting on the inner side of the head-plate. L is the drainage-hole of the draw-head. M is the concave inner surface of the bolt-heads *d d*′, which conforms to the periphery of ball K, but does not completely cover the surface of the ball in order to allow for the play of the bolt. The pocket G, placed immediately above draw-

head C, consists of top plate N, the downward flaring bottom plate O, notched at O′, to receive the shank of the bolt and the sides P, which also flare outwardly. The face of the pocket is not perpendicular, but inclined, the bottom projecting beyond the top to assist in guiding and retaining and impelling the bolt into place.

Draw-head C C′, may be provided with a terminal plate R, or the plate may be dispensed with, or the cylinder beyond the end of slot H, may be contracted to a lesser diameter, to facilitate its casting. The draw-head is ma-

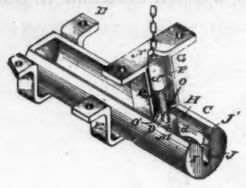
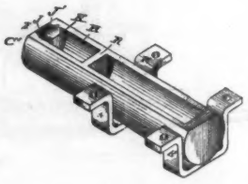


Fig. 3.



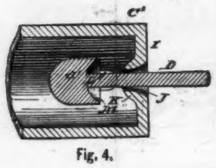


Fig. 4.

Fig. 5.

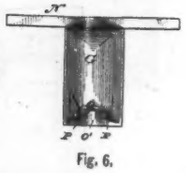


Fig. 6.

LEECH'S CAR-COUPLING.

terially reënforced at the top on both sides by concave shoulders S S, which also serve to guide the bolt home. It is also preferable to make the draw-heads cylindrical, as greater strength is obtained thereby, although they may be varied in shape without departing from the spirit of the invention. The brackets by which the draw-heads are suspended are preferably made square, as shown in the drawings, which greatly decreases the friction where a cylindrical draw-head is used. Pocket G, is also made in one casting. The shape of the bolt-head is preferably that shown in the drawings, being that of a truncated cone with the top rounded off; but the particular shape of the bolt-head is not essential so long as it is provided with an inner concave surface such as described.

The operation of the device is as follows: The brakeman having dropped the bolt D, into place by means of the chain attached thereto, it rests with head *d*, in the drainage-slot L, of draw-head C, and head *d′*, in pocket G, the shank of the bolt being held in the notch O′, at the bottom of the pocket. When the cars come together, the draw-heads C C′, are the first opposing points to meet and retreat beneath the car in the usual manner. The forward impulse thus given to the top of the bolt by the retreat of the lower end, as well as conveyed to the head resting in the pocket, throws head *d′*, out of the pocket G, and, guided by the shoulders S S, and the flare of the slot J, causes it to fall into the slot H, of draw-head C′, the head *d*, still remaining in draw-head C. When the train starts, the bolt-heads are drawn up against the balls K K, on the head-plates of the draw-heads and the coupling is completed. To uncouple, the bolt is removed by means of the chain, and is left hanging to the car when not in use.

The ball-and-socket joint allows of sufficient play of the bolt while the bearing is kept up over all the surface of the socket and ball whatever the angle given the bolt. Cars of different heights may thus be coupled with great facility and security, this point being one of the most important in all couplings. Instead of spreading the slot, and with it the head-plate and draw-head, the greater the pull the more firmly the two halves of the head-plate are bound together.

The whole device is simple, of easy adjustment, and not liable to get out of order.

McKinnis' Steam-Valve.

WM. C. MCKINNIS, of Red Bluff, Ark., has recently invented an improved steam-valve, whose construction and operation are shown in the accompanying cuts. The chief objects of the invention are to reduce friction to a minimum, to effect the adjustment of the parts, to take up or compensate wear, and to promote simplicity of construction.

Fig. 1 is a horizontal section of the improved slide-valve; Fig. 2 a longitudinal section, and Fig. 3 a cross section of the same.

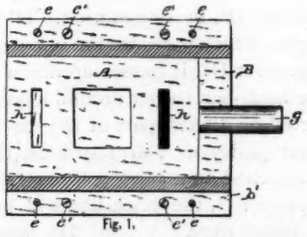


Fig. 1.

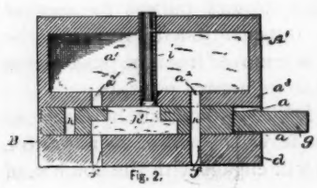


Fig. 2.

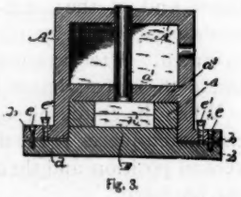


Fig. 3.

MC KINNIS' STEAM-VALVE.

The chest A′, is subdivided into the valve-chamber *a*, and the steam-chamber *a′*, the latter communicating with the valve-chamber by openings a^2, made in the dividing plate or partition a^3, between the chambers. The normally lower longitudinal edges of the steam-chest A′, are provided with flanges *b*, which are connected to the cylinder-plate *d*, by screws *e e*, at the corners, which plate, inside of the chest, is thickened up to form the valve-seat B, having steam-ports *f f*, through it.

Intermediately of the screws *e* are passed through the flanges *b*, additional adjusting-screws *e′ e′*, which do not, however, pass through the cylinder-plate *d*, but bear thereon, and are turned in the opposite direction to that in which the fastening-screws *e e*, are turned, whereby it will be observed that with the valve seated upon the elevated or thickened upseat B, (permitting the lower edge-flanges of the chest A′, to stand off normally from the cylinder-plate,) upon the wearing away of the valve and

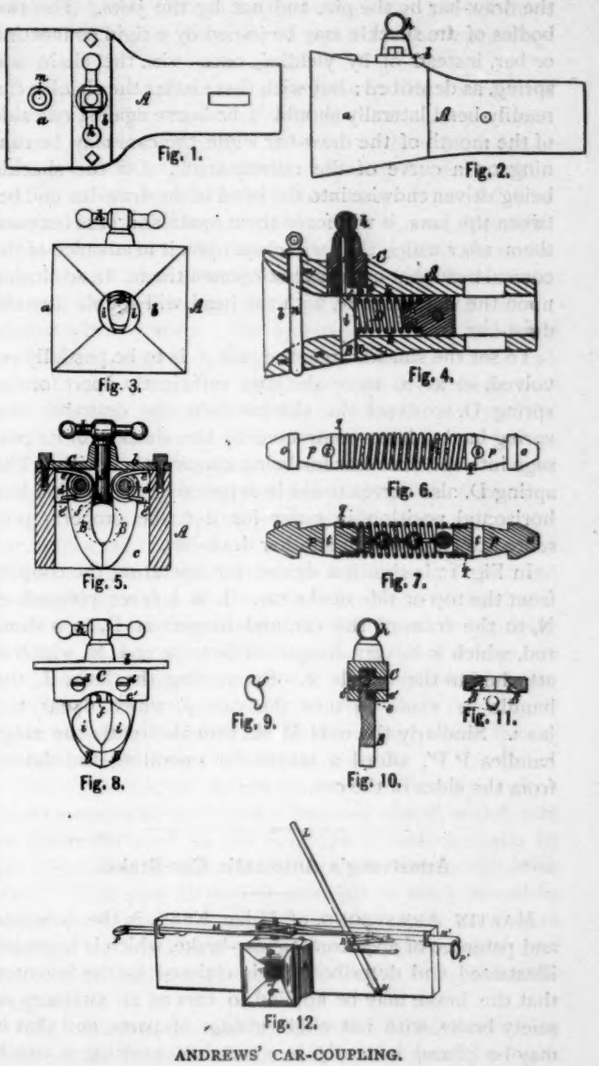
its seat, the wear can be readily compensated, the screws *e*, being tightened or turned to the right, while the screws *e'*, are turned in reverse direction. The valve A, is disposed in the chamber *a*, of the steam-chest A', and is provided with the usual stem *g*. The valve A, is provided with live-steam ports *h h*, and the intermediate exhaust-steam port *h'*. The live-steam ports are arranged well toward the ends of the valve, while in one side of the valve, the side next to the cylinder-plate or cylinder, the exhaust-steam port is of such length that when one of the live-steam ports is admitting steam to one side of the piston of the cylinder that end of the exhaust-steam port most distant from the live-steam port will be exhausting into a central pipe *i*, arranged to extend vertically through the chamber *a'*, of the chest A'; or it may in practice exhaust directly into the chamber *h'*, from which the exhaust-steam may be discharged through a pipe leading to a point below. The valve and steam-chest are designed to be long in proportion to the length of the cylinder, in order that the live-steam ports *h h*, may be short and economical in the use of steam, the friction of the valve not being increased by its length. Its length can be accommodated to any old valve-seat with great saving as to friction. The chest and valve can be used at the side as well as at the top of the cylinder. The valve can also be made self-adjusting by the use of metallic spring packing. It can also be used in practice with metallic or steel-spring packing.

The steam-chest and adjusting flanges are cast in one piece, and no bolts are employed save those used to secure it in position and adjust its lost motion, if there be any, while the ends of the valve-chamber may be closed with movable covers to exclude dust. It may be stated that the valve operates as effectively with ends exposed, as in case of their being closed, and any waste of steam can readily be detected.

Andrews' Car-Coupling.

JOHN S. ANDREWS, of Milltown, New Brunswick, Canada, is the inventor of an improved car-coupling, the operation of which is illustrated in the accompanying cuts. Fig. 1 is a top view, Fig. 2 a side elevation, Fig. 3 a front end view, Fig. 4 a longitudinal section, and Fig. 5 a transverse section, of the coupler, and Fig. 6 is a top view, and Fig. 7 a longitudinal section, of a shackle to operate with the coupler. Fig. 8 is a front elevation of the jaws and their support-piece, and Fig. 9 an under side view of the cam for opening the jaws. Fig. 10 is a vertical and transverse section of one of the jaws and its support-piece, and Fig. 11 a transverse section of the two jaws, showing the manner in which each jaw is beveled to receive the conical head of the shackle. Fig. 12 is a front view of the draw-head, showing an improved device for operating the coupler from the top or side of the car.

A is a draw-bar, having to its bunter or head *a*, a tapering mouth *b*. Directly in rear of such mouth, and in a narrow chamber *c*, in the draw-bar, there are arranged a pair of curved jaws B B, and the support-piece C, to which each of such jaws is pivoted. This support-piece is composed of a plate *b*, and two flanges *c' c'*, extending down therefrom parallel to each other, they being at a proper distance apart to receive between them the upper portions of the jaws, through which portions and the flanges the pivotal screws *d d*, of the jaws extend and screw into one of the flanges. Each jaw is provided with a spring *e*, suitably applied to it and the support-piece, designed for forcing the jaw toward its fellow. Between the two jaws there is arranged an S-shaped cam *f*, for moving them asunder, such cam being fixed on the lower end of an upright spindle *g*, journaled in the support-piece at its center, and extending above it, and provided with a



ANDREWS' CAR-COUPLING.

handle *h*. Each jaw is beveled or inclined from its outer to its inner edge, as shown at *i*. The support-piece is inserted and fastened within the draw-bar head, and there is directly in rear of the support-piece a cylindrical chamber *k*, which, formed in the draw-bar, contains a spiral spring D, which is to act as a bunter to the shackle-head on its passage between the jaws, and to expel it therefrom on their being opened for discharge of the shackle. In front of the support-piece there is extending down through the head of the draw-bar a hole *m*, for reception of a pin *n*, to enable the draw-bar, when necessary, to be connected to another adapted to receive a common shackling-link.

The shackle for use with the coupler, as described, has two conical heads *o o*, projecting from the smaller ends

of the two conically-shaped bodies *p p*, connected by a chain *r*, and having between them, and extending from one to the other, a spiral spring *s*, into which, at its ends, the bodies *p p*, are extended, as represented. The ends of the spring rest against shoulders *q*, formed in the bodies *p p*. Furthermore, there is in each of such bodies a hole *t*, which goes diametrically through the body, designed to receive the pin *n*, when the shackle is connected with the draw-bar by the pin, and not by the jaws. The two bodies of the shackle may be joined by a rigid connection or bar, instead of by yielding ones—viz., the chain and spring, as described; but with these latter the shackle can readily bend laterally should it be borne against one side of the mouth of the draw-bar while the cars may be running on a curve of the railway-track. On the shackle being driven endwise into the head of the draw-bar and between the jaws, it will force them apart and pass between them, after which they will close upon it in advance of the conical head that may have so opened them. In so closing upon the shackle they, with the head, will couple it to the draw-bar.

To set the shackle free, the cam *f*, is to be partially revolved, so as to force the jaws sufficiently apart for the spring D, to expel the shackle from the draw-bar, this spring having been contracted by the shackle in its passage into the draw-bar for being coupled therewith. The spring D, also serves to aid in supporting the shackle in a horizontal position, in order for it to be properly presented to engage with another draw-bar.

In Fig. 12 is shown a device for operating the coupler from the top or side of the car. L is a lever pivoted at N, to the front of the car, and hinged at R, to a short rod, which is in turn hinged at S, to a rod M, which is attached to the handle *h*. By moving the lever L, the handle is made to turn the cam *f*, which opens the jaws. Similarly the rods M M′, provided with the ring-handles P P′, afford a means for operating the device from the sides of the car.

Armstrong's Automatic Car-Brake.

MARTIN ARMSTRONG, of Milan, Kans., is the inventor and patentee of an automatic car-brake, which is herewith illustrated and described. It is claimed by the inventor that the brake may be applied to cars as an auxiliary or safety brake, with but slight change of parts, and that it may be placed instantly in operation, exerting a much greater force than could be given by a brakeman.

In the accompanying cuts, Fig. 1 is an elevation, partly in section, of an ordinary freight-car with the improvement attached, the new features and the ordinary brake mechanism being in elevation; Fig. 2 a perspective of the cramp-weight and its connections, located upon the top of the car; Fig. 3 a perspective detail of one of the car-axles, showing the operating-cam; Fig. 4 a detail view of the oscillating pawl-lever, to which the dog which operates over the axle-cam is pivoted, the view being taken at right angles to the position shown in Fig. 1; Fig. 5 a detail side view of the trip-lever and its connections with the operating-pawl; Fig. 6 an enlarged detail view of one of the jointed pawls, and Fig. 7 an enlarged view of the principal novel features detached from a car, including the trip-lever and its connections with the jointed pawls, the pawls, the ratcheted brake-bar, the oscillating lever, and its dog.

A designates the body of a freight-car; B designates the brake-shaft; *b* the chain; B′ the brake-bar, and *b′* the brake-lever. These parts are of ordinary and approved construction, except that the brake-bar B′, is provided with ratchet-teeth upon its upper side, and moves in suitable guides, and that the flexible connections are provided with a cushioning-spring, as shown at b^3. This rack-bar B′, is an important feature of the invention, being the point at which the auxiliary self-acting brake system combines and connects with the ordinary hand-brake devices now in use. Hence by removing the ordinary brake-bar and substituting the rack-bar B′, in its place, and providing such proper guides that the bar will be only capable of longitudinal movement, the invention may readily and at small expense be applied to freight-cars now in use.

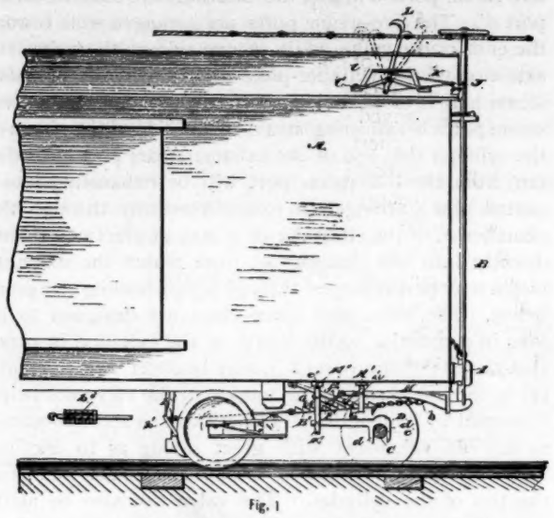


Fig. 1

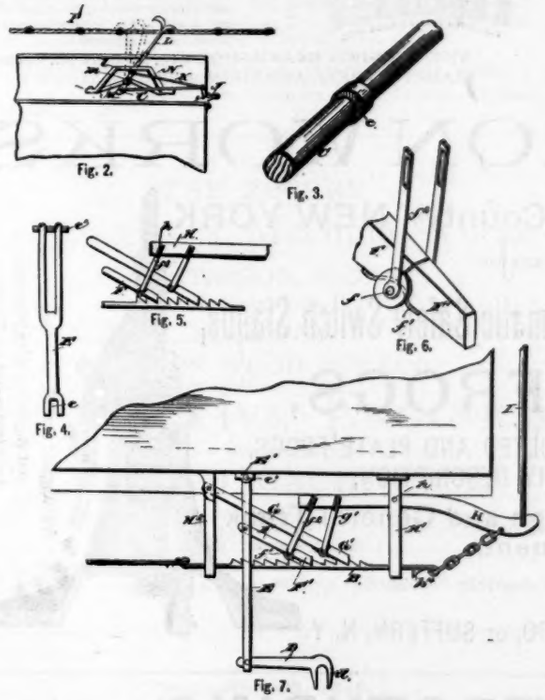
ARMSTRONG'S AUTOMATIC CAR-BRAKE.

Upon one of the truck-axles C, is secured an eccentric *c*, and with this eccentric is engaged a dog D, which is pivoted between the bifurcated arms *e*, of an oscillating lever E, pivoted to a block E′, upon the bottom of the car. The dog D, has a jaw *d*, which embraces the cam *c*, and it is held by its gravity in constant engagement therewith, giving to the lever E, a complete forward and backward oscillatory movement from its pivot with each revolution of the axle. The upper portion of this lever E, is bifurcated, both the upper duplex extremities being held by the single bolt *e′*, and in the recess formed between the two arms is pivoted at e^2, a pawl F, hinged at *f*, and having a spring *f′*, as shown, to hold the hinged arm F′, normally in a plane with the body of the pawl. This pawl F, being pivoted upon a bolt having bearings upon either side, is susceptible of a forward and back movement only, its free end traveling, when in operation, upon the toothed face of the brake-bar B′, and when out of operation being suspended directly above the same.

From the pivot of the hinge between the parts F and F′, which constitute the operating-pawl, a yoke f^2, extends upward, and is secured to the free or inner end of a trip-lever H, pivoted at *h*, in duplex frame H′, which is secured to the bottom of the car and extends downward,

having its lower ends connected by a cross-bar. Through this frame H′, the brake-bar B′, operates, and it serves as a guide therefor, as well as a stop to limit the longitudinal movement of the bar in one direction when a tooth b^4, upon the lower side of the brake-bar comes into contact with the cross-bar. The trip-lever is so arranged that its pivotal point is considerably away from the center, leaving its heavier end away from the pawl F, and the gravity of this heavier end is sufficient to raise the pawl F, out of engagement with the brake-bar B′ when the parts are in their normal position. The operation of the parts thus far described will be obvious. The normal condition of the operating-pawl is out of engagement with the brake-bar, as it is held by the gravity of the trip-lever, and the lever E, is continually but idly oscillated when the car is in motion by reason of the dog D, with the eccentric *c*.

H^2 designates another frame, similar to the frame H′, before described, and between its vertical arms is pivoted a holding-pawl G, having a hinged arm G′, and spring *g*,



ARMSTRONG'S AUTOMATIC CAR-BRAKE.

similar to the operating-pawl F. The pawl G, extends beyond the throw of the pawl F, and it is also connected to the inner end of the trip-lever by a tie *g′*, which extends from this lever to the hinge-pivot between the parts G and G′. The normal position of this pawl also is out of engagement with the brake-bar, as it is held by the gravity of the trip-lever. If, then, this gravity is overcome, it is obvious that the pawls F and G, would be thrown into engagement with the teeth of the brake-bar, and that at every revolution of the car-axle the pawl F, will throw the brake-bar one tooth forward, the holding-pawl G, will engage and hold the slack thus taken up, the pawl F, will retreat and engage the next tooth and again thrust the brake-bar the distance of one tooth, which will again be held by the pawl G, and so on until the last tooth has been engaged by the pawl, and it idly reciprocates upon a smooth portion thereof. By this means the brake is placed very powerfully into engagement with the truck-wheels, and will remain so until the gravity of the trip-lever again asserts itself and "knuckles" the pawls F and G, out of engagement. It will be understood that the brake-bar, the brake-shoes, and their connections are so conditioned and proportioned that the maximum or necessary brake force is applied when the last tooth of the brake-bar has been acted upon by the operating-pawl.

To the weighted end of the trip-lever H, is secured a tie-rod I, which, extending vertically, has its upper end secured to an elbow-lever J, pivoted to the upper edge of the car, and having its other arm loosely secured to a tie-rod K, which connects the elbow-lever J, to different points on a cramp-lever L, pivoted at *m*, to a frame M. A quadruped frame N, surrounds and is fixed above the frame M, and it has a recess in which the cramp-lever works loosely, and a bearing upon either side of the center, against which it rests. The upper end of the cramp-lever is weighted, so that as it passes upon either side of the pivotal point its gravity will impel it to its bearing, and hold it in that position until the lever is thrown past its center upon the other side. The tie-rod K, may be attached to the cramp-lever L, at *l*, above the pivot *m*, or at *l′*, below the pivot, so that a single motion of the rope P, will operate the brake properly, whichever end of the car is forward.

When in the position shown in full lines in Figs. 1 and 2 the heavier end of the trip-lever H, is elevated, and when in the position shown in dotted lines the trip-lever assumes its normal position and the pawls F and G, are held out of action, the gravity of the cramp-lever being sufficient to overcome that of the trip-lever. A spring or other proper means may be employed to prevent the accidental displacement of the cramp-lever.

The upper end of the cramp-lever is slotted or otherwise conditioned to receive a knotted rope P, which may be either operated by the engineer or automatically by the separation of the train, to throw the brake mechanism "on." This rope P, may be arranged to work in various ways—for instance, it may be reeved from the engine through or connected with all the cramp-levers and back, so that the engineer may operate it in either direction.

The cramp-levers may be connected with the ordinary brake-shaft B, and other modifications may be made without departing from the principle or sacrificing the advantages of the invention.

If one end of the car is forward, the tie-rod K, will have to be connected at the point *l′*, in order to have a "pull" motion overcome the gravity of the trip-lever, while if the other end of the car is forward the tie-rod will be connected t the point *l*, for the same purpose.

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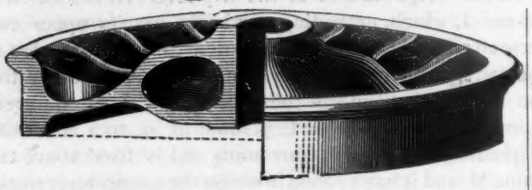

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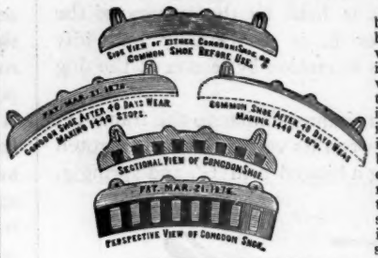

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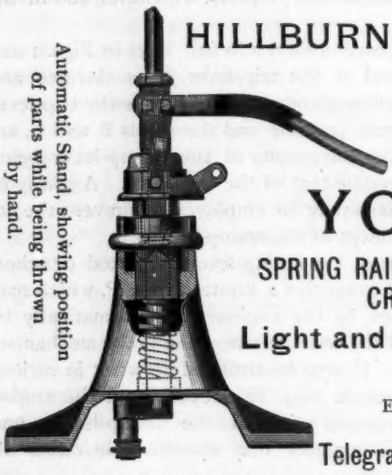
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Automatic Stand, showing position of parts while being thrown Automatically by Train.

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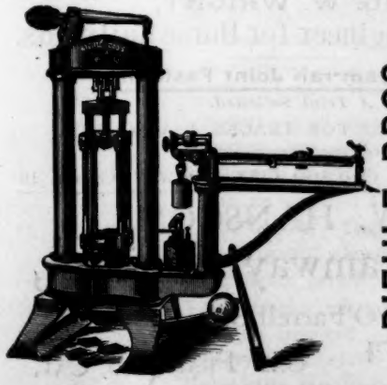

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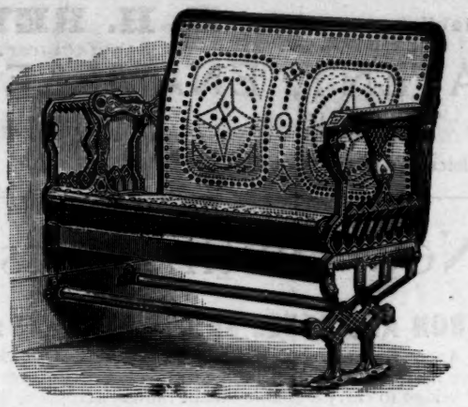

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